

Advanced Policy Analysis



The Potential Economic Benefits of Restoring Hetch Hetchy Valley

A study prepared for
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List of Abbreviations

CS: Consumer Surplus	DoE: Department of Energy
CV: Contingent Valuation	FERC: Federal Energy Regulatory Commission
ED: Environmental Defense	UNESCO: United Nations Educational, Scientific and Cultural Organization
DoI: Department of the Interior	WTP: Willingness-to-pay

Executive Summary: Restoration Benefits Potentially Large; Further Study Recommended

This study suggests that the combined use (recreation) and non-use (existence) benefits of a restored Hetch Hetchy Valley are potentially very large. Environmental Defense should use this information to direct public debate toward a discussion of potential restoration benefits while initiating further study to more precisely estimate restoration benefits.

This study attempts to estimate the magnitude of the potential gross benefits of restoring the Hetch Hetchy Valley, a smaller twin to Yosemite Valley located within Yosemite National Park. Environmental Defense is presently conducting a detailed feasibility study of Hetch Hetchy restoration alternatives, which enumerates most of the economic costs of restoration. A “ballpark” estimate of restoration benefits is needed in order to determine if proceeding with advocacy and/or further study is worthwhile.

This study finds that present discounted use (recreation) value ranges between:

- \$200 and \$600 million dollars for a low development scenario
- \$150 and \$850 million dollars for a medium development scenario
- \$247 million to \$1.4 billion for a high development scenario

Based on existing willingness-to-pay studies, it seems unlikely that the discounted present value of non-use (existence) value would be less than \$1 billion dollars and it is quite plausible that non-use benefits could be multiple billions of dollars.

However, the benefit estimates in this study are dependent upon:

- assumptions regarding the nature of potential demand for a restored Hetch Hetchy;
- how associated infrastructure is developed;
- choice of discount rate;
- quality and applicability of available data for benefits transfer.

While it is necessary to make assumptions regarding demand in order to estimate benefits using benefits transfer techniques, uncertainty surrounding visitation projections threatens validity of the use value estimate. Furthermore, existing non-use value data is for resources that are not quite comparable to Hetch Hetchy. While existing non-use value studies can give us an idea of the potential magnitude of existence values, reliable estimates of a restored Hetch Hetchy Valley’s non-use value cannot be made using the benefits transfer technique employed in this study.

The non-use value of a restored Hetch Hetchy Valley is likely to make up a greater portion of total benefits than use value. Although estimating costs and net benefits is not in the scope of this study, it is worth noting that, based on existing literature regarding possible restoration costs,

use benefits alone will likely be insufficient to overwhelm costs. Therefore, a good estimate of non-use value is critical to determining whether or not restoration has positive net benefits.

While non-use value is abstract and difficult to measure, the existence of a restored Hetch Hetchy Valley would add to the real income of millions of Americans and should therefore be taken into account in any thorough cost-benefit analysis. Failure to include a reasonable and reliable estimate of non-use value will lead to a gross underestimation of the potential benefits of restoration. Although controversial and not without flaws, contingent valuation surveys are the only tool available for measuring individual non-use benefits. Because of this, the Federal government uses and recommends contingent valuation for the estimation of both use and non-use benefits in cost-benefit analyses. Without contingent valuation, there is no way to capture the non-use benefits that may be the key to economically justifying the restoration of Hetch Hetchy Valley.

The following actions are therefore recommended:

- **Change the subject of debate:** Historically, debate has been dominated by discussions of cost with little or no attention given to the notion of net benefit. Refocus the Hetch Hetchy Valley restoration debate away from a cost focus and toward a discussion of the potential economic benefits of restoration.
- **Dedicate resources to further study:** Conduct original research in order to better estimate the net economic benefits associated with restoring Hetch Hetchy.
 - **Lay the groundwork through preliminary surveys:** Preliminary surveys gauging public awareness would be a good first step toward a full scale cost-benefit analysis.
 - **Invest in an original contingent valuation survey:** An original contingent valuation survey of the willingness-to-pay associated with a restored Hetch Hetchy Valley is the preferred option further benefits analysis.

In 1913, Congress granted the City of San Francisco the right to use Hetch Hetchy Valley as a reservoir. Throughout the century long discussion regarding Hetch Hetchy Valley's optimal use, however, no systematic cost-benefit analysis was undertaken to determine the economic value of alternative employments of the valley. Environmental Defense has an opportunity to re-shape the debate by turning the discussion away from the moral and legal arguments that restoration advocates have unsuccessfully employed in the past. A full-scale, rigorous cost-benefit analysis, including a contingent valuation survey, is the only way Environmental Defense can aggregate the many small, dispersed, individual benefits of restoration for comparison with the large, concentrated, status quo benefits to the City of San Francisco. Not only will this allow Environmental Defense to make a better internal decision about how to direct its own resources, it could also inform the broader debate and enable better public policy to be crafted around this issue.

1 The Problem: Economic Benefits of Hetch Hetchy Valley Restoration Are Unknown

Society's willingness-to-pay¹ for a restored Hetch Hetchy Valley is unknown. The lack of certainty surround the true net benefits of restoration hinders optimal decision making. The discussion concerning the damming and restoration of Hetch Hetchy has revolved almost entirely around the benefits of supplying water and electricity to San Francisco and the costs the City would incur if the dam were removed. Little or no consideration has been given to the benefits² associated with a restored Hetch Hetchy Valley. The feasibility study presently being conducted by Environmental Defense (ED), in cooperation with other organizations, focuses largely on the costs of restoration, including the costs of dam removal, finding alternate water storage sites, and any additional costs that would be incurred if the reservoir at Hetch Hetchy were drained. Without understanding the true economic benefits associated with restoration, there is no criterion for determining whether restoration is worth the cost. Thus, Environmental Defense must assess the economic benefits of restoration in order to frame the debate concerning the technical and political feasibility of restoration.

1.1 *Goals of the Advanced Policy Analysis: Estimate Benefits and Identify Issues for Further Analysis*

Conducting a benefits analysis enables the potential benefits accruing to various stakeholders to be monetized; these benefits can then be compared to the costs of restoration. Because Hetch Hetchy Valley is presently used as a reservoir, there is no outlet for the expression of demand for the alternate uses of the valley. **This benefits analysis attempts to fully enumerate the benefits that a restored Hetch Hetchy Valley would provide, and to estimate society's latent "willingness-to-pay" or demand for those benefits.** A numerical estimate of benefits will allow Environmental Defense to shift the debate toward a discussion of those benefits and the net benefits of restoration overall, rather than allowing the debate to be focused solely on costs. By providing a rough estimate of the magnitude of benefits, this analysis will also help Environmental Defense determine the necessity of investing in a full-scale cost-benefit analysis. This benefits analysis considers three possible scenarios for Hetch Hetchy Valley's restoration:

- High development—similar to Yosemite Valley at present;
- Medium development—minimal road-building, retail, and lodging development and requires visitors to access most of the Hetch Hetchy Valley on foot;

¹“Willingness-to-pay” is a term that will be used through out this report to refer to the amount individuals would theoretically pay to see Hetch Hetchy restored. Willingness-to-pay is equal to the “marginal benefit” individuals would experience from Hetch Hetchy's restoration. Willingness-to-pay and marginal benefits are equivalent to the height of the social demand curve for Hetch Hetchy's restoration; these terms may be used interchangeably throughout this report. This and other technical terms are further explained in the economic analysis.

² “Benefits” refers to the sum of individuals' willingness-to-pay, also known as the sum of marginal benefits. This is equivalent to the area under the social demand curve for restoration; further explanation in the economic analysis section and in the Appendix.

- Low development—restoration of Hetch Hetchy Valley’s habitat, but no road building, retail or lodging in the valley with camping and hiking permitted only at a low volume, similar to Yosemite National Park’s high country areas.

Due to time and budget constraints, this analysis does not involve primary research methodologies; rather it relies upon secondary valuation methodologies. However, the results of the analysis may lead to Environmental Defense or other parties investing time and money in further study of the benefits of restoration. **The analysis therefore describes issues, problems, and methodologies which could be incorporated into a future, full-scale cost-benefit analysis that may pin down a more accurate estimate of “willingness-to-pay”.**

2 History & Political Context: Political Maneuvering Trumps Rigorous Policy Analysis

Summary of History and Political Context

- With the passage of the Raker Act in 1913, the City of San Francisco succeeded in convincing Congress and the President that it was in the best interests of the nation to apply Hetch Hetchy Valley to the purpose of supporting the development of a great city rather than allowing the valley to remain in its natural state.
- From the City's perspective, the Raker Act grants San Francisco full and complete property rights to Hetch Hetchy Valley. To many others, the City is getting a free resource at the tax-payers' expense.
- No cost-benefit analysis was done at the time the decision was made to dam Hetch Hetchy and no attempt has ever been made to quantify the effective subsidy the City receives from the Federal government or to calculate the value of a restored/non-flooded Hetch Hetchy Valley.
- Restoration proponents have drawn national media attention to the idea of removing the dam at Hetch Hetchy, but thus far, have done little to show that the benefits to the nation would indeed outweigh the costs of restoration.

The controversy regarding the damming of Hetch Hetchy Valley was the first major clash between developers and conservationists. The debate lasted roughly ten years (approximately 1904-1914) and pitted the City of San Francisco against environmentalists led by John Muir. The City regarded Hetch Hetchy as the means by which it could secure its future survival in a state already experiencing water scarcity problems. Winning the right to use Hetch Hetchy as a reservoir meant water security, sanitation, and economic independence to the City. To Muir, Sierra Club members, and nature preservationists around the country the City's actions to secure Hetch Hetchy Valley represented a land grab in one of the nation's most hallowed National Parks. Emotions ran, understandably, high. Muir was successful in organizing opposition for nearly ten years, but those in favor of damming the valley were more politically powerful, better organized, and savvier at arranging legislative support. **The City of San Francisco succeeded in convincing Congress it was in the best interests of the nation to apply Hetch Hetchy Valley to the purpose of supporting the development of a great city rather than allowing the valley to remain in its natural state.**

The legislation authorizing the damming of Hetch Hetchy, known as the Raker Act, requires the City to pay \$30,000 per year to the Federal government for the use of Hetch Hetchy. This amounts to roughly \$82 per day, or less than the cost of one night at many of the hotels near the

Park's entrance. The City pays the National Park Service approximately \$1.4 million per year for watershed maintenance services carried out by the Park in the area surrounding Hetch Hetchy. Essentially, the City of San Francisco gets the water itself for free, paying only for maintenance and piping the water from the Sierra Nevada's to the City. **From the City's perspective, the Raker Act grants San Francisco full and complete property rights to Hetch Hetchy Valley. To many others, the City is getting a free resource at the tax-payers' expense.**

No cost benefit analysis was done at the time of the original legislation authorizing the damming of the Hetch Hetchy Valley. This is understandable, as the discipline of modern economics was in its infancy in the early part of the century. However, as the debate has continued, and greater understanding has developed regarding how to compare the costs and benefits of public works projects, no new studies have been undertaken to clarify the full costs and benefits of the Hetch Hetchy reservoir. The costs and benefits to the City of San Francisco have been enumerated, but **no attempt has ever been made to quantify the effective subsidy the City receives from the Federal government, or to calculate the value of a restored/non-flooded Hetch Hetchy Valley.** The City, and many non-city agencies evaluating the restoration issue, has viewed the annexation of the valley as "costless". Since the land was in a National Park, it was and is viewed by the City as free.

The debate over whether to remove the dam at Hetch Hetchy Valley has flared up periodically over the years. Prior to the present discussion, the most serious consideration given to restoring Hetch Hetchy was in 1987-88, when Interior Secretary Don Hodel proposed studying the matter. Then, as now, the City of San Francisco acted vigorously to dismiss any notion that it does not hold the absolute property rights to the use of Hetch Hetchy Valley. The City has also opposed any idea that the potential benefits of restoration might outweigh the costs—and for the City of San Francisco, the costs would indeed very likely outweigh the benefits, particularly since the City gets \$40-50 million per year in revenue from the sale of the water and electricity produced by the Hetch Hetchy system. **Restoration proponents have drawn national media attention to the idea of removing the dam at Hetch Hetchy, but thus far, have done little to show that the benefits to the nation would indeed outweigh the costs of restoration.**

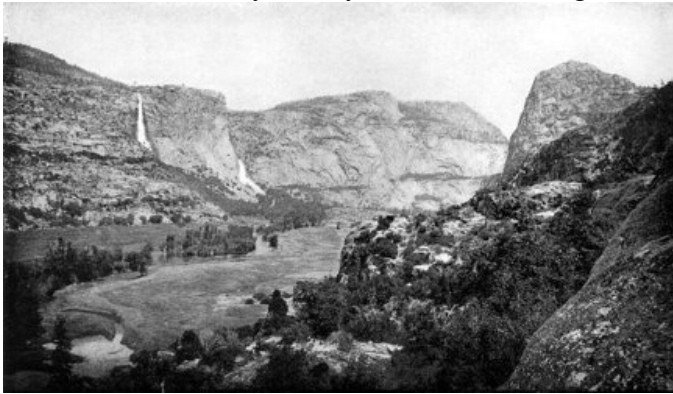
For further details of the history of the Hetch Hetchy damming and restoration controversy, please see Appendix III.

2.1 Are They Comparable? Comparing Hetch Hetchy to Yosemite Valley, Then and Now

Opponents of damming Hetch Hetchy and advocates of its restoration, often invoke comparisons of Hetch Hetchy Valley and Yosemite Valley. Prior to the dam controversy, Josiah D. Whitney, former State Geologist of California noted the similarity. "It [Hetch Hetchy Valley] is not on quite as grand a scale as [Yosemite] Valley; but if there were no Yosemite, the Hetch Hetchy would be fairly entitled to a world-wide fame; and, in spite of the superior attractions of the Yosemite, a visit to its counterpart may be recommended, if it be only to see how curiously

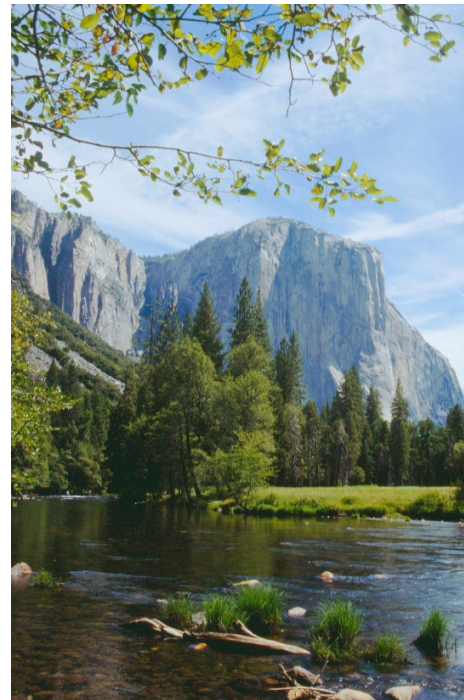
nature has repeated herself." ³ Yosemite Valley is larger (3 times the length) and Yosemite Valley's walls rise higher than Hetch Hetchy Valley's (3200 ft. vs. 2500 ft.). Still, Hetch Hetchy Valley was called by observers a "perfectly-cut little gem" and its floor was referred to as a "beautiful emerald meadow". ⁴ Photos illustrate the striking similarities.

Hetch Hetchy Valley Prior to Flooding



(Photo Source: Sierra Club⁵)

Yosemite Valley Today



(Photo Source: Andre Winter⁶)

³ Whitney, Josiah D. *The Yosemite Book* Chapter 4, "The High Sierra" 1869.

⁴ "Restoring Hetch Hetchy" Assembly Office of Research, Ca. State Legislature, No.0220-A, June 1988.

⁵ Historic Hetch Hetchy photographs by Photographs by J. N. LeConte, available at <http://www.sierraclub.org/ca/hetchhetchy/>

⁶ http://www.carto.net/andre.mw/photos/1996/07/02_usa/1996072206_ca_yose_el_capitan.jpg

No Hetch Hetchy advocate was more famous than John Muir who wrote: “Dam Hetch Hetchy! As well dam for water tanks the people’s cathedrals and churches, for no holier temple has ever been consecrated by the heart of man!”⁷ Yet, some have argued that Hetch Hetchy Valley was in fact beautified, or at the very least, not scenically harmed by the flooding:

Senator John Raker: Taking the scenic beauty of the Park as it now stands, and the fact that the valley is sometimes swamped along in June and July, is it not a fact that if a beautiful dam is put there, as is contemplated, and as the picture is given by the engineers, with the roads contemplated around the reservoir and with other trails, it will be more beautiful than it is now, and give more opportunity for the use of the Park? [...] In other words, to put it a different way, there will be more beauty accessible than there is now?

Gifford Pinchot, U.S. Chief Forester: “Much more beauty will be accessible than now.”⁸

Hetch Hetchy Today



(Photo Source: Restore Hetch Hetchy⁹)



(Photo Source: Galen Rowell, 1987¹⁰)

⁷ John Muir, *The Yosemite* (New York: Century, 1912), 255–257, 260–262. Reprinted in Roderick Nash, *The American Environment: Readings in The History of Conservation* (Reading, Mass.: Addison-Wesley Publishing Company, 1968).

⁸ U.S. Congress, House of Representatives, Committee on the Public Lands, Hearings, Hetch Hetchy Dam Site, 63d Cong., 1st Sess. (June 25–28, July 7, 1913), pp. 25ff.

⁹ www.hetchhetchy.org

¹⁰ Photo copyright by Galen Rowell, <http://www.mountainlight.com>.

3 Benefits Analysis: General Methodology

Summary of General Methodology

- Due to time and budget constraints, this analysis attempts to estimate benefits using the secondary valuation method of benefits transfer.
- The analysis is conducted from a U.S. national perspective.

In cases involving a unique resource and a controversial project, primary research focused specifically on the site in question is the ideal method of estimating benefits.¹¹ However, as Hetch Hetchy Valley has been under water for the better part of a century, it is difficult to apply revealed preference techniques directly. A thorough benefits analysis would likely incorporate an original, carefully designed contingent valuation survey in order to measure the public's stated willingness-to-pay for a restored Hetch Hetchy Valley. However, large scale contingent valuation studies take time (usually the better part of a year) and can cost upwards of \$1 million dollars¹²; an original contingent valuation study is therefore, far beyond the time and budget constraints of this analysis.

This analysis attempts to estimate benefits using the secondary valuation method of benefits transfer. Benefits transfer involves using existing knowledge about a resource that has been studied to estimate the benefits at a second site that has not been studied. Although primary research is optimal, when time and budget constraints do not allow for original research, benefits transfer is a good second choice. (The worst choice is to ignore benefits that cannot be directly estimated.)¹³ Although not as accurate as primary research, this is often a good technique for making a “first pass” to see if benefits merit primary research. A benefits transfer involved three steps:

- 1) Identify resources/services to be valued;
- 2) Identify and evaluate existing studies; collect any necessary data;
- 3) Transfer benefits.

Each of these steps is explored further in following sections.

¹¹ Black, Robert. et. al. “Economic Analysis for Hydropower Project Relicensing: Guidelines and Alternative Methods” Prepared for Division of Economics, U.S. Fish and Wildlife Service, USDOL, October 1998.

¹² Interview with Michael Hanemann, UC Berkeley Agricultural and Resource Economics Professor and leading expert on contingent valuation, 23 February 2004.

¹³ Rosenberger, Randall S.; Loomis, John B. 2001. “Benefit transfer of outdoor recreation use values: A technical document supporting the Forest Service Strategic Plan (2000 revision).” Gen. Tech. Rep. RMRS-GTR-72. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 59 p.

A major decision to be made regards the question of standing: whose benefits matter in this analysis? In other words, who would actually pay for a restored Hetch Hetchy and whose willingness-to-pay counts? The answer to this question can have a great impact on the level of overall benefits; therefore, standing must be carefully considered. Table 1 summarizes the perspectives which inform this analysis.

Table 1: Benefits Standing

	California	National	International
Use Value	<p>A restored Hetch Hetchy value would arguably be of most direct use to the people who live in the area; 53% of total visitors to Yosemite National Park come from California.</p> <p>Habitat restoration likely to be of greatest benefit to Park visitors, half of whom are Californian.</p> <p>Increased revenue of tourism largely local to Tuolumne County.</p>	<p>The large numbers of people who visit Yosemite every year from all of the country could experience greater benefits if Hetch Hetchy were restored.</p> <p>Habitat restoration likely to impact non-endangered North American species.</p>	<p>24% of total visitors to Yosemite reside in other countries.</p> <p>Carbon sequestration is valuable on the global scale, but the additional carbon to be sequestered is likely to be negligible.</p>
Non-Use Value	<p>Hetch Hetchy's existence matters most to those most intimately acquainted with the Park and its history.</p>	<p>Yosemite is a National Park, essentially the property of all Federal taxpayers, and Hetch Hetchy's existence can legitimately be said to "matter" to all Americans.</p>	<p>The vast majority of the world's population doesn't know Yosemite exists; individual WTP would have to be estimated very conservatively, perhaps as a function of income.</p>

One of the three perspectives must be applied to the entire benefits analysis. An international perspective would provide the most comprehensive view. This is justified for two main reasons:

- Many international visitors (24% of total visitors) come to Yosemite every year implying the great value they place on the existence of, and opportunity to visit the Park's attractions.
- UNESCO lists Yosemite National Park as a World Heritage site; the Park and everything it contains can therefore be considered an "international treasure".

An international perspective, however, means that one must consider the value which non-U.S. residents would place on a restored Hetch Hetchy Valley despite the fact that U.S. residents are the ones who will likely shoulder the entire cost of restoration. U.S. taxpayers are unlikely to be willing to restore Hetch Hetchy Valley based on the benefits its existence provides to, for example, the Japanese. Even if conservative techniques were used to estimate per-person willingness-to-pay, the magnitude of international benefits may dwarf the benefits U.S. residents experience and sway the outcome of the analysis.

At the same time, limiting the analysis of benefits to California ignores the legitimate interest and claim that all U.S. citizens have in Yosemite National Park. Half of all visitors to Yosemite National Park are from outside California. The Park was created by an act of Congress and Hetch Hetchy's flooding was authorized by an act of Congress—there is no doubt that any restoration of Hetch Hetchy Valley would also require authorization of Congress. U.S. tax dollars pay for

<i>Table 2: Visitors to Yosemite National Park by Origin¹⁴</i>	
Origin	Percentage of Total Visitors
USA	76%
International	24%
California	53%

(Source: Yosemite National Park Press Kit)

National Parks, including Yosemite, and any restoration would likely be partially funded through U.S. Federal tax dollars. While it is true that many of the costs of restoration (e.g. the cost of finding an alternative water storage site) would be born by San Francisco and residents of northern California, all Americans presently bear the cost of using Hetch Hetchy Valley as a reservoir. **Therefore, the analysis is conducted from the U.S. national perspective.** However, the existence of additional, non-US beneficiaries is noted.

Following is a general theoretical analysis of benefits, followed by a more in depth benefits transfer analysis for each of the Hetch Hetchy restoration scenarios under consideration.

¹⁴ Yosemite national Park Visitor Use Statistics 1985-2004; included in Yosemite National Park press kit, updated 15 March 2004.

4 Understanding a Restored Hetch Hetchy Valley's Potential Economic Benefits

Summary of General Economic Assumptions & Analysis

- This analysis addresses gross benefits, not net benefits.
- Current demand for visits to Hetch Hetchy is “uninformed.” Post restoration demand would be “informed.” Informed demand is higher than uninformed demand.
- Individual willingness-to-pay will vary depending on the level of development in Hetch Hetchy Valley; individual willingness-to-pay higher at lower levels of development than at higher levels of development.
- The use of Hetch Hetchy Valley as a reservoir is mutually exclusive with its alternate uses—if any of the reservoir benefits are to be captured, all of the alternative use benefits must be forgone and vice versa.
- The non-use value or “existence value” of a restored Hetch Hetchy Valley may be larger than the use value. Benefits transfer can, at best, provide rough estimates of non-use value. Contingent valuation is the best tool available for estimating non-use value, but its reliability is the subject of controversy.

The economic value of Hetch Hetchy Valley is dependent upon the goods and services the valley provides and society's willingness-to-pay for those goods and services. Willingness-to-pay describes an individual's marginal benefit, or demand, for a given good. The sum of all individuals' marginal benefits is referred to as social benefit. Benefits are not dependent on what any individual or society as a whole actually pays; gross social benefit only describes the value to society in terms of what would be paid at a maximum. Net benefit is total social benefit minus total social cost; please note that this report is not analyzing costs, only benefits. Therefore, **all benefits described in this analysis are gross benefits rather than net benefits.**

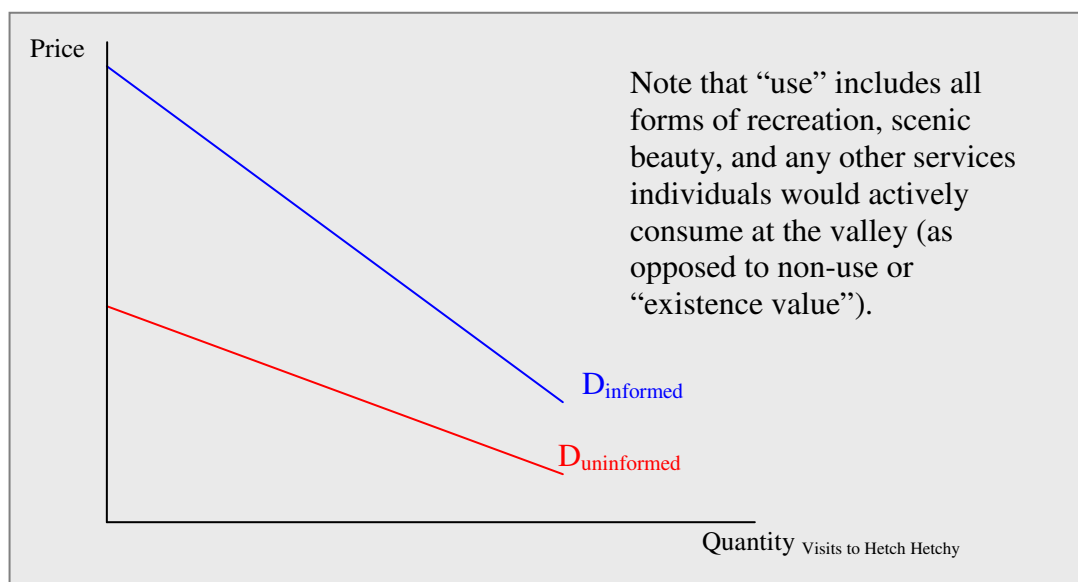
The benefits that derive from people physically being in or using the valley are categorized under the heading “Use Value.” Benefits that do not involve direct use of the valley will fall under the heading “Non-Use Value”. Use and non-use value are analyzed separately below and in subsequent sections.

4.1 Use Value

Figure 1 represents total demand for the use of Hetch Hetchy Valley, as measured by visits to the valley. **The uninformed demand curve reflects the assumption that current demand for visits to Hetch Hetchy Valley is low due to lack of information.** It is assumed that informed

demand would be much higher and that, if the public knew about Hetch Hetchy Valley, what it looked like prior to flooding and its potential offerings if restored, many more people would be willing-to-pay to restore and visit the valley. Last year 25,200 people visited the reservoir at Hetch Hetchy, making it the least visited feature of Yosemite National Park. There are some indications, however, that this number is artificially low due to lack of information about Hetch Hetchy. Scott Gediman, Yosemite National Park's Chief of Media Relations notes that visitation to Hetch Hetchy spiked when the Yosemite Guide (a quarterly Park publication handed out to all entering visitors) featured a cover story on Hetch Hetchy. Ron Good of Restore Hetch Hetchy was informed by National Park Service rangers that visitation at Hetch Hetchy increased three-fold during the time Park visitors received this edition of the Yosemite Guide.¹⁵ If more people knew about Hetch Hetchy, says Gediman, more people would visit.¹⁶ This sentiment is echoed by Yosemite National Park Ranger Deb Schweizer who notes that if the dam were removed there would be "a ton of local and national media attention," which would play an important role in educating the public about Hetch Hetchy and attracting new visitors.¹⁷ Advocates argue that a successful restoration campaign would include a sustained national publicity blitz, which would serve to raise awareness of the valley.

Figure 1: Demand for the Use of a Restored Hetch Hetchy Valley- Informed vs. Uniformed Demand



Also key to the lack of present demand for visiting the Hetch Hetchy area is San Francisco's stewardship of the reservoir and surrounding area. In the years following the dam's construction, San Francisco banned visitors to Hetch Hetchy. When it was pointed out that the City was required by the Raker Act to build trails around the reservoir, and that the City had made promises prior to the construction of the dam to that effect, visitors were finally allowed access. However, the City restricted visitation hours and banned over-night camping. At the same time, "San Francisco officials have treated Hetch Hetchy as their own private preserve, maintaining a

¹⁵ From Ron Good letter to Yosemite NP Superintendent Michael Tollefson and Chief of Interpretation Chris Stein, dated November 28th, 2003

¹⁶ Interview with Yosemite National Park Chief of Media Relations, Scott Gediman, 5 April, 2004.

¹⁷ Interview with Yosemite National Park Ranger, Media Relations, Deb Schweizer, 5 April, 2004.

chalet at the reservoir for their exclusive use.”¹⁸ Yosemite National Park’s web site includes the following description of Hetch Hetchy: “Hetch Hetchy, a lesser known twin to Yosemite Valley (perhaps because its river has been dammed), is home to spectacular scenery and is the starting point for many less-used wilderness trails.”¹⁹ Finally, a Tuolumne County Chamber of Commerce official was quoted as saying ““Hetch Hetchy? Nobody knows it is there except for us [Tuolumne County residents]. The Park service doesn’t market it anyway. We would like to change that.”²⁰ All of this goes to suggest that present demand is uninformed.

Mono Lake: A Case Study of Informed vs. Uninformed Demand

Mono Lake is located 13 miles outside Yosemite National Park’s Tioga Pass entrance station. A salty inland sea with unusual geological formations near the shore, Mono Lake’s water level began to decline after the City of Los Angeles began diverting water from sources that normally flow into the Mono Basin. The salinity of the sea doubled, disrupting an ecosystem that serves as an important habitat for millions of migratory and nesting birds. In the late seventies, the Mono Lake Committee was organized to reverse the decline of the Mono Lake ecosystem. After several legal and political battles, a restoration plan was created and Los Angeles was ordered to comply by lowering the amount of water it diverts from tributaries of the lake. The publicity caused by the “Save Mono Lake” campaign stimulated public interest in the area, and visitation to the area has greatly increased.

Since the Mono Lake Committee began its campaign over 20 years ago, visitation to the Mono Lake area rose from an extremely low level to approximately 250,000 annual visitors presently. A state reserve was established at Mono Lake in 1981 and in 1984 the area was officially designated as a National Forest Scenic Area. In the early 1990’s, after a well publicized court battle, Los Angeles was ordered to participate in a plan to restore Mono Lake. A contingent valuation study was used to help determine the optimum level of restoration. After a new Scenic Area visitors’ center was built near the lake in 1992, visitation increased 10-15% per year before leveling off at 120,000 visitors to the new center each year. The Mono Lake Committee has grown to a member base of 15,000 and recreation in the area has increased steadily over the years.

(Source: Mono Lake Committee²¹)

It is further assumed that individual willingness to pay for recreation in Hetch Hetchy Valley would be different depending on which development scenario (high, medium, or low) results from restoration. It was originally hypothesized that high development would provide greater access and more recreation opportunities to more people—i.e. total willingness-

¹⁸Glionna, John. “San Francisco in a Hetch-22 Over Dam” Los Angeles Times, Sunday, August 11, 2002.

¹⁹Yosemite National Park website; *Trip Planning, What to Do, Areas to Visit*; available at:

<http://www.nps.gov/yose/trip/places.htm>

²⁰ Interview with Peggy Mosely, Board member, Tuolumne County Chamber of Commerce; interview conducted by Elizabeth Gettleman and originally cited in her 2003 APA: “Yosemite’s Other Valley: Hetch Hetchy Restoration and Its Potential Impact on Tuolumne County.”

²¹ Interview with Mono Lake Committee Eastern Sierras Policy Coordinator, Jen Nissenbaum. 28 April 2004.

to-pay would be highest for a highly developed Hetch Hetchy Valley. Yet **there is evidence that individual willingness-to-pay is higher for a less crowded, higher quality recreation experience.** A 1980 economic analysis of the Yosemite Management Plan, completed by economist Richard Walsh, asserts that higher levels of development in Yosemite Valley and the Park as a whole result in lower benefits per visitor day. In his study, Walsh evaluated four alternatives for the management of Yosemite National Park, as well as analyzing the status quo consumer surplus²² experienced by visitors to the Park. His results are summarized in Table 3.

Table 3: Data Show Consumer Surplus Partially Based On Crowding

Alternative	Description	Per Visitor Per Day Benefits (2003\$) ²³
Super-high Development Plan (proposed by concessionaire)	Lodging and facilities added to the valley floor; crowding projected to increase.	\$6.21
Status Quo as of 1980		\$11.16
Medium Development Plan or “Compromise Plan”	Reduced traffic in Yosemite Valley and removal of non-essential services from Valley Floor, but to a lesser extent than the proposed management plan.	\$11.61
Proposed Yosemite Management Plan	Congestion lowered in Y.V. visitor capacity decreased in the valley but increased in the Park as a whole.	\$13.78
Environmental Preservation Plan	All parking moved to satellite lots, lowest level of congestion in Yosemite Valley, all non-essential services removed from Y.V., Hetch Hetchy Reservoir drained ²⁴ , environmental preservation throughout park.	\$18.26

²² Consumer surplus implies the individual net benefit to the visitor, i.e. total benefit minus the cost of getting to the Park or any fees associated with entering the Park.

²³ It should be noted that the conversion to 2003 dollars was made using a CPI inflation calculator; were the benefits escalated to account for the increasing scarcity of open spaces, benefits would likely be even higher.

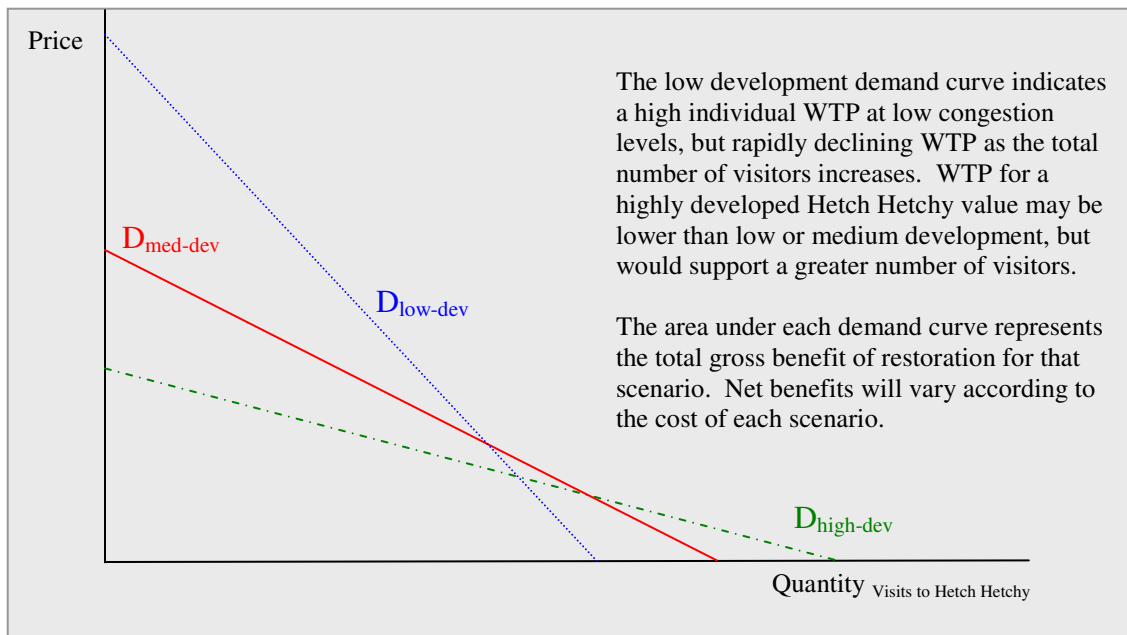
²⁴ Although alternative two mentioned drainage of Hetch Hetchy Valley, Walsh assumed zero increase in visitation to Hetch Hetchy and did not assume any additional consumer surplus from restoring the valley; he only added the cost of dam removal to the total cost of Alternative 2.

(Source: Walsh 1980)

Walsh concludes that the differences in consumer surplus are due almost entirely to differences in the quality of the visitor experience in each scenario, which is primarily a function of crowding and congestion. Decreased congestion leads directly to higher benefits per visitor day.²⁵ This finding was subsequently echoed in a 1982 study by Walsh, Loomis, and Gilman that found willingness-to-pay increased as a function of decreasing congestion in the Indian Peaks Wilderness Area of Colorado.²⁶

In analyzing the benefits of restoring Hetch Hetchy Valley, it is therefore assumed that the medium and low development scenarios might provide higher quality recreation, albeit to fewer people than a high development scenario would. Those in search of pristine, beautiful back-country hiking and camping within the valley may have a lower price elasticity of demand (steeper demand curve) than day-trippers who want their scenic beauty cheap, visible by car, and with a side of fries. This means that in a low-development scenario fewer people visit (because there is less access by car and less visitor support infrastructure) but those that do visit value their trip more highly. Conversely in a high development scenario, individual willingness-to-pay is low, but more people may have access to Hetch Hetchy Valley. In all cases, individual willingness-to-pay declines as the number of visits increases.

Figure 2: Current Demand for the Use of a Restored Hetch Hetchy Valley – Varying Demand by Scenario

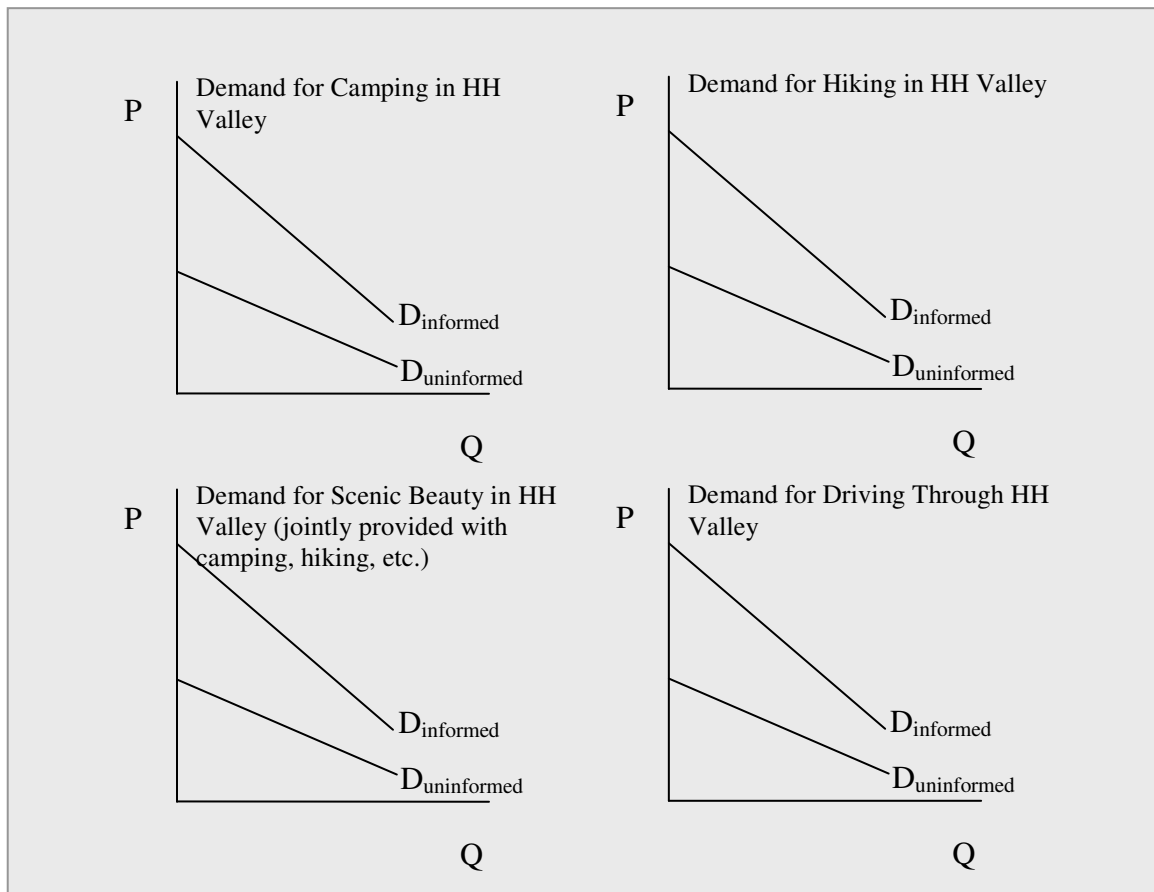


²⁵ Walsh, Richard. "An Economic Evaluation of the General Management Plan for Yosemite National Park" Colorado Water Resources Research Institute, Colorado State University, Technical Report No. 19, 1980.

²⁶ Walsh, et. al. "Wilderness resource economics: recreation use and preservation values" Denver: American Wilderness Alliance, 1982.

“Use value” can be theoretically broken down further into each of the services a restored Hetch Hetchy Valley would provide, such as camping, hiking, scenic beauty, etc. Similar to the informed and uninformed demand curves for overall visits to Hetch Hetchy, for any one of these separate services, we can also imagine an informed and uninformed demand curve.

Figure 3: Overall Demand Can Be Broken Down by Unique Services the valley Provides



The graphs illustrate the idea that there is some willingness-to-pay, and therefore some potential benefit, associated with all of the goods and services a restored Hetch Hetchy Valley could provide. **Note that the use of Hetch Hetchy Valley as a reservoir is mutually exclusive with its alternate uses—if any of the reservoir benefits are to be captured, all of the alternative use benefits must be forgone and vice versa.** Also note that some of the goods that a restored Hetch Hetchy Valley would provide could be provided jointly—“scenic beauty” would be consumed at the same time as “hiking” is consumed, for example. When estimating the value of jointly provided goods, double-counting must be avoided.

Although use-value can theoretically be broken down into component parts, studies of individual willingness-to-pay for outdoor recreation rarely present values for these individual components. While there are studies that evaluate willingness-to-pay for one activity versus another (e.g. jet skiing vs. fishing) there is little data on jointly provided goods such as hiking and scenic beauty.

More commonly, researchers evaluate willingness-to-pay for “general recreation” in a given area.

4.2 *Non-Use Value*

The economic benefits of a unique natural resource may be felt by more people than just the users of that resource. These additional benefits are referred to as “Non-Use Value.” While this value is somewhat abstract, **non-use value may, in fact, make up a larger portion of the benefits of a resource than use value.** Economist John Krutilla originated the concept of non-use value when he wrote in 1967: “When the existence of a grand scenic wonder or a unique and fragile ecosystem is involved, its preservation and continued availability are a significant part of the real income of many individuals.” Krutilla mentions John Muir and other nature lovers as people “for whom the loss of a species or the disfigurement of a scenic area causes acute distress and a sense of genuine relative impoverishment.” Krutilla goes on to characterize the preservation of natural wonders, scenic areas, species, etc. as a public goods problem, and argues that although there is no mechanism for individuals to honestly express their willingness-to-pay to preserve nature, that willingness-to-pay may exceed the value of alternative uses.²⁷ A Department of the Interior (DoI) guide to economic analysis for dam re-licensing projects cites Krutilla’s argument and urges the Federal Energy Regulatory Commission (FERC) to incorporate non-use value in its analysis of hydropower re-licensing projects. The DoI guide notes “For some FERC re-licensing cases, non-use values may be relevant and significant. The rivers involved often offer unique preservation or restoration opportunities.”²⁸

An excellent illustration of non-use value was the recent debate over the Bush Administration’s plans to drill for oil in the Arctic National Wildlife Refuge (ANWR). There was a huge public outcry against drilling in ANWR despite the fact that very few people will ever visit or use the Refuge. Many people valued ANWR’s existence as a wild, unspoiled place regardless of any use value. According to a 2002 Gallup poll, while 35% support drilling, 56% of Americans oppose drilling in ANWR “with opponents much more intense in their views than are supporters.”²⁹ This example demonstrates how non-use value may outweigh use value—the Bush Administration was attempting to increase ANWR’s use value at the expense of its non-use value. The protest against doing so shows that for many people, the non-use value of ANWR outweighed any potential use value. Scott Gediman of Yosemite National Park observes: “As we develop more and more, wild places become more and more valuable. Most people don’t visit Yosemite back country, but are comforted it’s there.”³⁰ This echoes Krutilla’s argument that “natural environments will represent irreplaceable assets of appreciating value with the passage of time.” Often in the debate over natural resources such as Hetch Hetchy, advocates of using or exploiting the natural resource argue that since non-use or existence value is difficult to quantify,

²⁷ Krutilla, John “Conservation Reconsidered” American Economic Review, Vol. 57, 1967, p.777-786.

²⁸ Black, et. al. “Economic Analysis for Hydropower Project Relicensing: Guidance and Alternative Methods” Prepared for Division of Economics, US Fish and Wildlife Service, Department of the Interior, by Industrial Economics, Inc. 1998

²⁹ Moore, David W. “Public Opposes Oil Drilling in ANWR” Gallup Organization Poll Analysis, 24 April, 2002. Available at <http://www.gallup.com/content/login.aspx?ci=5884>.

³⁰ Interview with Yosemite National Park Chief of Media Relations, Scott Gediman, 5 April, 2004.

it should not be counted in the debate. Dismissing non-use value, however, would be a grave mistake and lead to the gross underestimation of the value people place on conservation, preservation, and restoration.

We can say with confidence that Hetch Hetchy Valley does have some associated non-use value or the willingness of individuals to pay for “just knowing it’s there,” exclusive of any value an individual places on the various uses of the valley for recreation, etc. Furthermore, Hetch Hetchy has an inherent “iconic value” both because it is located within a famous U.S. National Park and also because the Hetch Hetchy debate arguably gave birth to the California environmental movement. The difficulty lies in estimating this non-use value. The technique used for the estimation of non-use value is contingent valuation, which essentially estimates value by asking people what they would be willing to pay to preserve a given resource. Unfortunately, asking people their willingness-to-pay does not always elicit an honest response: often there are incentives to misstate willingness-to-pay and sometimes people have difficulty assessing their own true willingness-to-pay. There are a variety of techniques for designing surveys cleverly to overcome incentives for individuals to overstate or understate their willingness-to-pay. Outside of laboratory experiments, however, no contingent valuation technique has succeeded in eliciting a *verifiably truthful* willingness-to-pay from respondents. Willingness-to-pay surveys in particular (as opposed to willingness-to-accept surveys), may underestimate the value that respondents place on a resource. When asked how much they would be willing to accept to compensate for the loss of a given resource, individuals invariably name a higher amount than they would be willing to pay to preserve the same resource. Few economists deny the existence of non-use value and most acknowledge that it can be greater than use value; yet, many economists question the reliability of contingent valuation.³¹

Inconsistency between willingness-to-pay versus willingness-to-accept has been the subject of research by psychologists and experimental economists and is hypothesized to be the result of framing effects (the way the questions are asked) and loss aversion (greater aversion to potential loss than excitement about potential gain). Additionally, when public goods are involved, the temptation to free-ride off of the contributions of others gives incentive for individuals to understate their willingness-to-pay. Finally, critics of contingent valuation argue that individuals sometimes fail to take their real budget constraints into account when stating hypothetical willingness-to-pay. **At present, however, contingent valuation is the only tool available for estimating non-use value.** As Professor Lee Friedman of the Goldman School of Public Policy at U.C. Berkeley notes in his text, the *Microeconomics of Public Policy Analysis*, the inconsistencies found in contingent valuation

should not be interpreted as implying that contingent valuation surveys are invalid. Indeed ... [Willingness-to-Pay] indicators derived from careful contingent valuation studies may be reasonable indicators of value. The U.S. Department of Interior, as well as other agencies, makes use of such studies. The conclusion of a blue-ribbon panel commissioned by the National Oceanic and Atmospheric Administration to review this methodology stated that contingent valuation studies ‘can produce estimates reliable

³¹ Boardman, et. al. Cost-Benefit Analysis: Concepts and Practice. Second Edition. Prentice Hall, 2001.

enough to be the starting point of a judicial process of damage assessment, including lost passive-use values.’³²

U.S. Federal agencies that use contingent valuation as a method for valuing both use and non-use benefits include the Department of Interior and the Department of Agriculture. Loomis notes that “TCM and CVM have been recommended twice by the U.S. Water Resources Council (1983) under two different Administrations” as preferred methods for estimating use (particularly recreation) and non-use values.³³ The only alternative to using contingent valuation is to simply leave out estimates of non-use value when assessing benefits. As stated previously, however, this approach risks grossly underestimating true benefits.

An ideal benefits transfer would draw on non-use data based on contingent valuations for resources very similar to Hetch Hetchy Valley (e.g. Yosemite Valley). In the specific case of Hetch Hetchy Valley, the issue is complicated by the lack of existing research regarding the benefits of comparable resources. As such, rather than using contingent valuation data relating to Hetch Hetchy specifically, this analysis will attempt to extrapolate a range of values for non-use value using contingent valuation data from other sites.

³² Friedman, Lee S. *The Microeconomics of Public Policy Analysis*. Princeton University Press, 2002.

³³ Loomis, John B. “Economic Values of Wilderness Recreation and Passive Use: What We Think We Know at the Beginning of the 21st Century” USDA Forest Service Proceedings RMRS-P-15-VOL-2. 2000

5 General Assumptions & Detailed Scenario Descriptions

Summary of General Visitation Assumptions

- People will continue visiting Yosemite National Park. Visitation will likely increase over the next 10 years.
- Hetch Hetchy visits would be seen as a complement to, not a substitute for visits to Yosemite Valley.
- Restoration itself will generate new visits.
- Visitation to the Hetch Hetchy area can continue through the draining of the reservoir and removal of the dam. Visitors can access the valley floor as soon as it is exposed.

Summary of General Biological Restoration Assumptions

- The dam will be drained over a 5 year period.
- Visitors can access portions of the valley floor as soon as they are exposed by draining; the ecosystem is least delicate immediately following draining.
- Vegetation will cover the valley floor within 5 years of draining.
- Complete restoration is possible with intensive management and would occur within 100-150 years after draining.

Thus far we have generally described the methodology used to estimate the benefits of restoring Hetch Hetchy and have given a brief economic analysis that describes the basic characteristics of these benefits. Before proceeding with the benefits transfer analysis additional assumptions regarding visitation in general must be clarified. Additionally, assumptions relating to restoration itself must be explained.

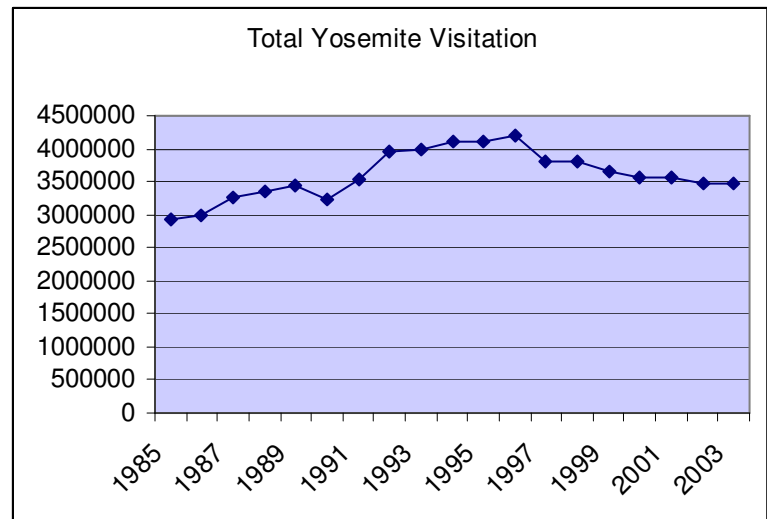
5.1 Visitation

In order to analyze the use-value benefits of a restored Hetch Hetchy Valley, projections regarding the number of visitors a restored Hetch Hetchy Valley is likely to draw are essential. While the number of visitors to a restored Hetch Hetchy Valley is partially dependent upon the restoration scenario, i.e. the level of development on the valley floor and infrastructure available

to support visitors, there are several assumptions regarding visitation that can be generalized to all three restoration scenarios.

The first assumption regarding overall visitation is that more visitors will keep coming to Yosemite National Park. Despite a long term trend of overall growth, visitation to Yosemite National Park has actually been declining in recent years—visitation in 2003 was 3.5 million down from 4.2 million in 1996.³⁴ However, park officials believe that the decline is easily explained and will reverse itself in the next decade. The reasons given for the decline include:

- Catastrophic flooding in 1997 caused Yosemite Valley to be closed for three and a half months;
- Entrance fee increased from \$5 to \$20 in 1997
- Four murders committed inside and outside the Park by a local handyman in 1999; this generated a lot of negative publicity in Northern California.
- Decreased tourism overall due to the terrorist attacks of September 11th, 2001.
- Decreased tourism due to overall poor economy.³⁵



(Data Source: Yosemite National Park Press Kit)

Media Relations Chief Scott Gediman notes that the decline in visitation to Yosemite National Park is consistent with decreases in visitation to other National Parks throughout the country. This decline is also consistent with a decrease in visitation to private sector tourist destinations, such as Disneyland, Disneyworld, and Universal Studios—in fact, Gediman says that the decline in visitation to National Parks is less severe than the decline in visitation to private sector destinations. Yosemite National Park does not make official projections regarding visitation, but Gediman believes that visitation will start to increase again over the next 2-3 years and that visitation to Yosemite National Park will hit the 4 million mark again within 5-10 years. Gediman observes that, despite the dip in visitation, the valley is still quite crowded with 3.47 million visitors in 2003.³⁶ Supporting this claim is the fact that the California region closest to Yosemite National Park, the Central Valley, is experiencing extremely fast population growth—some of the fastest growth in the country. Counties near the Park such as Stanislaus, Calaveras, and Merced in particular are growing rapidly.³⁷ Since over 50% of total visitors to Yosemite

³⁴ Yosemite National Park Visitor Use Statistics 1985-2004; included in Yosemite National Park press kit, updated 15 March 2004.

³⁵ Interview with Yosemite National Park Ranger, Media Relations, Deb Schweizer, 5 April, 2004.

³⁶ Interview with Yosemite National Park Chief of Media Relations, Scott Gediman, 5 April, 2004.

³⁷ US Census Bureau, California Quick Facts, Available at http://quickfacts.census.gov/qfd/maps/california_map.html

National Park come from California, population growth in nearby counties has the potential to significantly contribute to increases in visitation.

Also important in projecting visitation to a restored Hetch Hetchy Valley is the nature of the complement/substitute relationship between Hetch Hetchy and Yosemite Valley. If a restored Hetch Hetchy Valley were to act as a substitute to a crowded Yosemite Valley, thereby siphoning off visitors from one site to the other, the benefits of Hetch Hetchy visitors could only be counted to the extent that they are above and beyond the benefits they would have experienced at Yosemite Valley. If however, Hetch Hetchy Valley acts as a complement to Yosemite Valley, visitors to Hetch Hetchy would be either new visitors to the Park, or visitors who see both Yosemite and Hetch Hetchy during their trip. The benefits that Hetch Hetchy visitors experience could be taken whole without subtracting the lost Yosemite Valley benefits. **There is evidence that the relationship between demand for visitation to Yosemite Valley and Hetch Hetchy Valley would be complementary as opposed to competitive.**

Sixty percent of visitors to Yosemite are repeat visitors, and Ranger Deb Schweizer says “Tradition drives repeat visitors.” She argues that many visitors to Yosemite come to the same places they have been visiting since they were children. If Hetch Hetchy were restored, people would not stop visiting Yosemite Valley because the valley holds a lot of meaning and history for repeat visitors.³⁹ Another category of visitors are those that are coming to “hit the highlights”.

These visitors often come by bus and spend only 2 to 3 hours in the Park. Park officials assert that these visitors will never stop coming to Yosemite Valley, a restored Hetch Hetchy notwithstanding. Yosemite Valley has an iconic value that will continue to draw visitors even if another feature is added to the Park. Station Chief Gediman says that people do not come to Yosemite Valley expecting a “wilderness experience”; the fact that the valley is overcrowded is well known, but people still keep coming to see the major waterfalls and monoliths. Rather than drawing visitors away from Yosemite Valley, Gediman believes a restored Hetch Hetchy would generate new visitors. Gediman believes “it is a fallacy to think a restored Hetch Hetchy would draw visitors away from Yosemite Valley”; rather it would function as an added attraction to the Park.⁴⁰ Figure 4, based on a 1998 survey conducted by the Yosemite Area Regional Transportation Strategy (YARTS), shows that the reservoir at Hetch Hetchy is the least visited area in the Park. This is consistent with the evidence suggesting that present demand for Hetch Hetchy is uninformed. Figure 4 also shows that while Yosemite Valley is by far the most visited attraction in the Park, about 12% of visitors in 1998 visited Tuolumne Meadows and around 15%

Table 4: Repeat Visitation to Yosemite National Park³⁸

Origin	% respondents who indicated they were repeat visitors
US	40%
International	22%
California	84%
Total	60%

(Source: Yosemite National Park Press Kit)

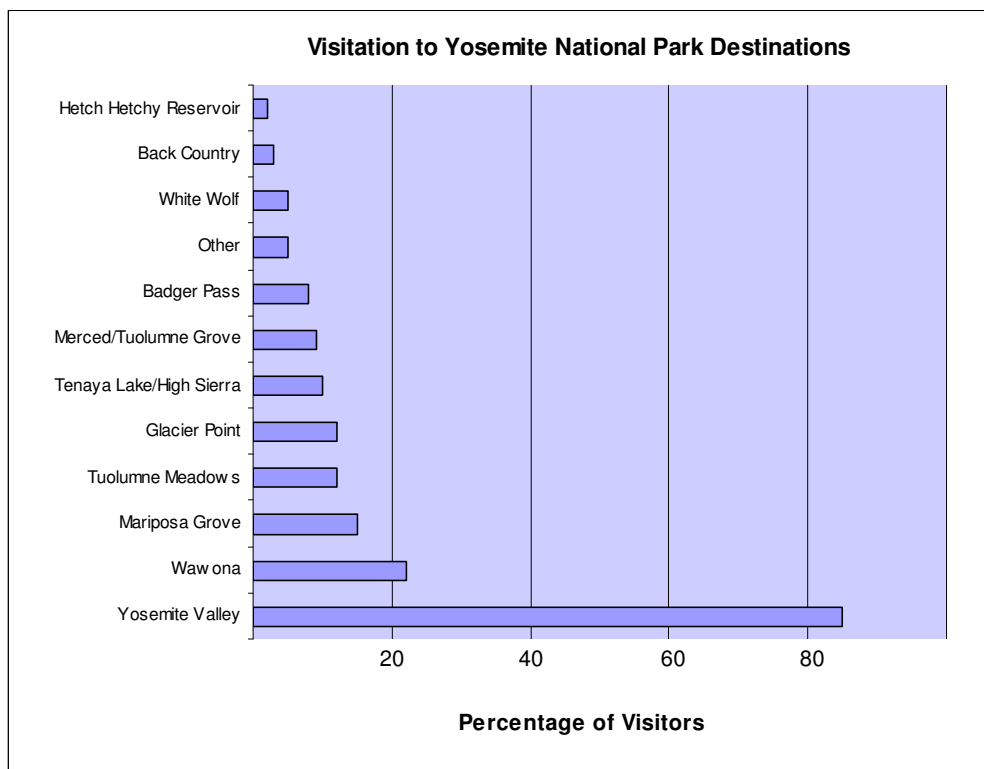
³⁸ Exit Survey, Yosemite National Park Visitor Use Study: August 1999.

³⁹ Interview with Yosemite National Park Ranger, Media Relations, Deb Schweizer, 5 April, 2004.

⁴⁰ Interview with Yosemite National Park Chief of Media Relations, Scott Gediman, 5 April, 2004.

visited Mariposa Grove.⁴¹ Gediman describes these areas as complimentary to Yosemite Valley, and believes Hetch Hetchy has the potential to function as a complimentary attraction if restored.

Figure 4: 1998 Visitation Data Shows Hetch Hetchy Least Visited Area of the Park



(Data Source: YARTS Survey, 1988)

It is also likely that the restoration process itself would generate new visits. Yosemite National Park Ranger Deb Schweizer argues that new visitors would be generated due to the novelty of the restoration itself. Calling Hetch Hetchy “the ultimate restoration project” she says it would be very exciting to see the ecosystem restore over time and believes many people would come to see Hetch Hetchy to watch the process. Schweizer notes that in small, localized restorations within Yosemite Valley “we sometimes see flowers and plant species come back that we didn’t even know still existed in the valley... watching that process occur on a massive scale in Hetch Hetchy Valley would be very exciting.”⁴² A National Park document describing potential Hetch Hetchy restoration scenarios notes: “A rare opportunity will be provided to observe animal dispersal and re-colonization much as it occurred following the disappearance of the glaciers that made this park what it is.”⁴³ The California Assembly Office of Research noted

⁴¹ Ross, Michael. “YARTS Survey Provides New Insights.” Yosemite Area Regional Transportation Strategy (YARTS) Survey, 1998

⁴² Interview with Yosemite National Park Ranger, Media Relations, Deb Schweizer, 5 April, 2004.

⁴³ National Park Service, Alternatives For Restoration Of Hetch Hetchy Valley Following Removal Of The Dam And Reservoir, February 1988

in its analysis of Hetch Hetchy restoration that “this national ‘experiment’ in restoration would undoubtedly result in a huge number of visitors to the site.”⁴⁴

There are precedents for “restoration tourism”. Prior to the eruption of Washington State’s Mount Saint Helens in 1980, the area was primary a local/regional recreation destination.⁴⁵ Approximately 260,000 vehicles per year visited the Mount Saint Helens area prior to the 1980 eruption.⁴⁶ Most visitors were local, few if any were out-of-state. After the eruption, the site was designated a National Monument in 1982. In 1982 visitation was 1.2 million, a more than 4-fold increase from 1980. Visitors came from across the globe to see how the ecosystem responded to the devastation caused by the eruption. By 1990 visitation had increased 13 percent over the 1982 figure.⁴⁷

Almost twenty-five years later, the novelty has by no means worn off. Because the landscape at Mount Saint Helens continues to change, according to Mount Saint Helens National Monument’s Chief of Interpretation, Gala Miller, many visitors are repeat visitors who come to see the progress and changes in the ecosystem.

Furthermore, the interest and learning stimulated by the eruption and restoration there have led to sustained visitation levels over time. A contributing factor to Mount Saint Helens continuing popularity is the major capital investment program that has been occurring in the Mount Saint Helens Monument over the past 15 years. New infrastructure and facilities have been built, which allows the area to accommodate more visitors than it might have in the past. Two new visitors’ centers were built in 1994 and 1997; each now attracts many visitors.⁴⁸

Mark Cederborg, project manager with Hanford ARC (Applied Restoration Conservation), a San Francisco Bay Area engineering firm specializing in ecosystem restoration, says that **people could visit the Hetch Hetchy Valley floor as soon as it is drained**. “The valley floor is least delicate right after the dam is removed—there is nothing there to destroy. People would have the opportunity to see up close what a completely destroyed ecosystem looks like and watch over the years as it rebuilds.”⁴⁹

⁴⁴ “Restoring Hetch Hetchy” prepared by the Assembly Office of Research, California State Legislature, No.0220-A, p. 27, June 1988.

⁴⁵ Interview with Jamie Anderson, Mt. Saint Helens Interpretive Ranger, Cowlitz Visitor Center; interview conducted by Elizabeth Gettleman and originally cited in her 2003 APA: “Yosemite’s Other Valley: Hetch Hetchy Restoration and Its Potential Impact on Tuolumne County.”

⁴⁶ Mount Saint Helens General Plan 2000. Originally cited in Elizabeth Gettleman’s 2003 APA: “Yosemite’s Other Valley: Hetch Hetchy Restoration and Its Potential Impact on Tuolumne County.”

⁴⁷ *Mount Saint Helens Regional Visitor Industry Development Program* (Harrison Price Company, Malcolm D. McPhee & Associates, 1982) Originally cited in Elizabeth Gettleman’s 2003 APA: “Yosemite’s Other Valley: Hetch Hetchy Restoration and Its Potential Impact on Tuolumne County.”

⁴⁸ Interview with Mount Saint Helens National Monument Chief of Interpretation, Gala Miller, 19 April, 2004.

⁴⁹ Interview with Mark Cederborg, Project Manager, Hanford ARC. 9 April, 2004.

5.2 Assumptions Regarding Dam Removal and Biological Restoration

The details of dam removal and the process of biological restoration will affect the timing of benefits, particularly use benefits. For example, Mark Cederborg's assertion, quoted in the previous section, that visitation to the Hetch Hetchy Valley floor could occur as soon as draining is complete, implies that use benefits could begin accruing as soon as the valley is drained. The way in which the dam removal and biological restoration is managed by the Park Service would also impact visitation patterns. According to a document prepared by the National Park Service in 1988, there are three alternatives for the management of the restoration: 1) "Recovery with no management", 2) "recovery with moderate management" and 3) "recovery with intensive management".⁵⁰ According to restoration specialist Mark Cederborg, the most realistic of these scenarios is alternative 3, "recovery with intensive management." He argues that "Recovery with no management" is neither likely nor truly feasible given the Park Service's history of active restoration projects throughout the Park. The middle alternative, argues Cederborg, is too open to interpretation ('moderate' is ambiguous) and not different in its details from the third alternative "recovery with intensive management." Cederborg endorses the Park Service's description of the steps, timeline, and likely outcome of restoration, with one exception (Cederborg believes the Tuolumne will require human intervention to remain in its original channel after the reservoir is drained.)⁵¹ For the purposes of this analysis, it will be assumed that Hetch Hetchy Valley is restored in accordance with the "recovery with intensive management" scenario as described in the National Park Service's 1988 document "Alternatives For Restoration Of Hetch Hetchy Valley Following Removal Of The Dam And Reservoir". See Appendix IIII for a listing of the biological assumptions and projected events associated with restoration. The timeline below is based on these assumptions.

⁵⁰ National Park Service, Alternatives For Restoration Of Hetch Hetchy Valley Following Removal Of The Dam And Reservoir, February 1988

⁵¹ Interview with Mark Cederborg, Project Manager, Hanford ARC. 9 April, 2004.

Restoration Time Line

Dam drainage begins.

Plants begin to establish in drained portion of the valley.

Dam drainage complete.

Vegetation covers valley floor.

Native plants prominent in the valley.

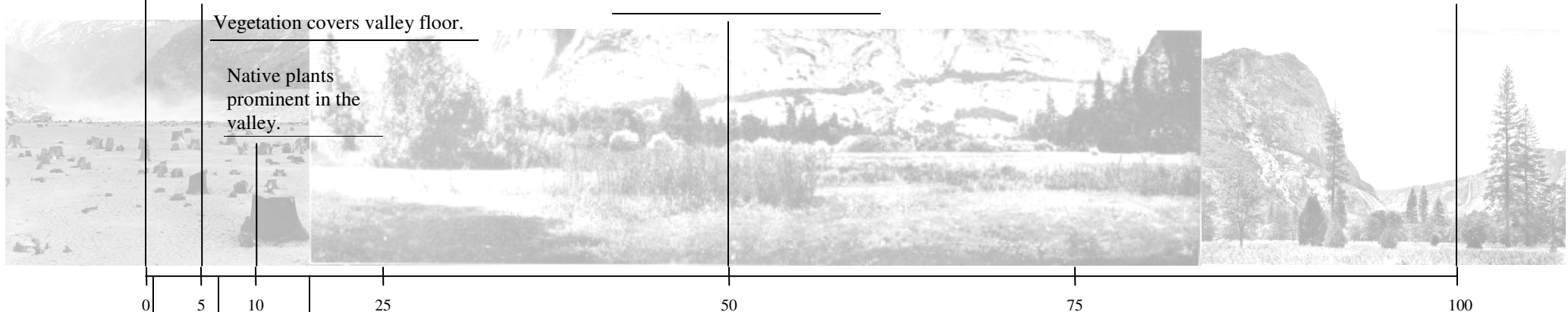
Prey for peregrine falcons improves.

Small mammals and reptiles return to the valley.

Deer and black bears begin returning to the valley.

Plant community boundaries would be stabilizing and would resemble those that originally occurred in Hetch Hetchy.

Tall ponderosa pines and cedars. Oak woodlands beginning to mature.



“The long term result would be all but two native species resident in Hetch Hetchy Valley in abundances and distributions that would closely reflect pristine conditions.”

National Park Service, “Alternatives For Restoration Of Hetch Hetchy Valley Following Removal Of The Dam And Reservoir”, February 1988.

5.3 Development Scenario Descriptions

Summary of Assumptions Specific to Low Development Scenario

- Visits to Hetch Hetchy will be limited by a lack of transport and lodging infrastructure.
- The capacity of a low-development Hetch Hetchy Valley will be about 400,000 visitor-days or approximately 200,000 individual visitors annually.
- Individual willingness-to-pay for recreation in Hetch Hetchy will be highest in a low-development scenario, although this scenario allows the fewest number of visitors.

Summary of Assumptions Specific to Medium Development Scenario

- A road will be built to take visitors to the valley floor.
- The capacity of a medium-development Hetch Hetchy Valley will be about 600,000 visitor-days, or approximately 300,000 individual visitors.
- Individual willingness-to-pay for recreation in Hetch Hetchy will be less than the low development scenario, but greater than for the high development scenario.

Summary of Assumptions Specific to High Development Scenario

- Visits to a highly developed Hetch Hetchy Valley will be higher than in any other development scenario, but could never be as high as Yosemite Valley due to smaller size and infrastructure constraints.
- The capacity of a high-development Hetch Hetchy Valley will be about 1,000,000 visitor-days, or approximately 500,000 individual visitors.
- Individual willingness-to-pay for recreation in Hetch Hetchy will be the least of any of the scenarios under consideration due to the increased congestion in the valley.

As mentioned earlier, the benefits associated with three alternative restoration scenarios need to be assessed in order to give an idea of the full range of possible benefits. The following sections provide a detailed description of the scenarios under evaluation and scenario-specific assumptions.

5.3.1 Low Development

In the “low development” scenario, after the reservoir is drained and the dam removed, very little, if any, construction would occur on the Hetch Hetchy Valley floor. No additional infrastructure would be built to transport or accommodate visitors on the valley floor. Additional trails would be added on the valley floor and back country camping would be permitted, but no prepared camp sites would be constructed. The existing camp sites and ranger station near Hetch Hetchy would remain. The chalet presently used by the City of San Francisco as a retreat for city officials could be turned into a visitors’ center or a visitors’ center could be built nearby along the road leading to the valley. The existing road would be maintained, but not widened or changed in any other way to accommodate more visitors. Visitation to the area could continue throughout the time that the reservoir is drained and visitors could access drained parts of the Hetch Hetchy Valley floor soon after they are exposed.⁵² Visitors would have to hike down to the valley floor, as the existing road and parking lot is a bit higher than the top of the dam at present, i.e. about 350-400 feet above the valley floor. While the valley is being drained and the dam is still in place, visitors could continue to walk on top of the dam, as they do now, for an excellent view of the restoration in progress.

Initially, much of the new visitation would be related to the restoration itself. Many visitors would seek to visit Hetch Hetchy simply to view a dramatic, large scale restoration in progress. As the draining would take approximately 5 years, we can assume this effect will last at least 5 years, although the valley floor would continue to change at a fast pace for an additional 10-15 years after draining is complete. The publicity surrounding the restoration would serve to educate the public about Hetch Hetchy’s existence, much as the eruption at Mount Saint Helens not only drew “restoration tourists,” but also made Mount Saint Helens a national attraction that, 20 years later, still continues to draw five times the number of visitors it did prior to eruption.⁵³

In the low development scenario, demand for visits to Hetch Hetchy would likely exceed supply. The primary determinant of visitation is the lack of infrastructure to support a greater number of visitors. According to Yosemite National Park Historian Jim Snyder the existing narrow 2-lane road to Hetch Hetchy cannot bear the traffic of millions of visitors per year. Visitation in Yosemite, says Snyder, has historically been keyed to the construction of roads and available facilities.⁵⁴ Although it is likely that many will wish to see the valley during and after restoration, without improved roads, additional camping and lodging, and no transportation into the valley floor itself, capacity would be the lowest of the three restoration scenarios. An analysis of restoration done by the California Assembly Office of Research predicts: “if no new facilities are provided, other than new parking, the visitation would be [...] possibly **400,000 visitor-days**⁵⁵ per year (1100 per day on average).”⁵⁶ This is consistent with

⁵² Interview with Mark Cederborg, Project Manager, Hanford ARC. 9 April, 2004.

⁵³ *Mount Saint Helens Regional Visitor Industry Development Program* (Harrison Price Company, Malcolm D. McPhee & Associates, 1982) as originally cited by Elizabeth Gettleman in “Yosemite’s Other Valley: Hetch Hetchy Restoration and Its Potential Impact on Tuolumne County.” Advanced Policy Analysis, Goldman School of Public Policy, U.C. Berkeley, 2003.

⁵⁴ Telephone interview with Yosemite National Park Historian James Snyder, 17 March 2004.

⁵⁵ Note that visitor-days is the product of visitors times the number of days they stay; the report notes that visitor-days are about double the number of visitors, indicating an average stay of 2-days.

⁵⁶ “Restoring Hetch Hetchy” prepared by the Assembly Office of Research, California State Legislature, No.0220-A, p. 27, June 1988.

1980 statistics suggesting visitor stays in Yosemite Valley of 2 to 3 days⁵⁷ in length. Thus, 400,000 visitor-days is equivalent to about 200,000 park visitors. While Scott Gediman, Chief of Media relations at Yosemite National Park, suggests that a restored Hetch Hetchy could potentially draw as many visitors as Tuolumne Meadows or Mariposa Grove, the low development scenario would not provide the infrastructure to support the number of visitors that presently visit those areas (approximately 340,000 annually to Tuolumne Meadows and 510,000 annually to Mariposa Grove)⁵⁸

Gediman observes that a restored, less developed Hetch Hetchy Valley would be analogous to a “wild Yosemite Valley.”⁵⁹ Evidence suggests that individual willingness-to-pay for recreation in a less crowded Yosemite Valley would be far higher than individual willingness-to-pay in a more developed Yosemite Valley. **It is therefore noted that the per person benefits of recreating in a lesser developed Hetch Hetchy Valley would be greater than the benefits of recreating in a more developed Hetch Hetchy Valley.** For ranges of individual willingness-to-pay for recreation, the low development scenario is at the higher end of the range.

5.3.2 Medium Development

In the “medium development” scenario, after the reservoir is drained and the dam removed, moderate construction would occur on the Hetch Hetchy Valley floor. The road leading to Hetch Hetchy would be improved, and after the reservoir is drained and the dam removed, the road would be extended part of the way into the valley. Additional trails would be added on the valley floor and some prepared camp sites would be constructed. The existing camp sites and ranger station near Hetch Hetchy would remain. As in the low development scenario, the chalet would be turned into a visitors’ center or a visitors’ center would be built nearby along the road leading to the valley. Also, as in the low development scenario, the dam would remain intact during draining. Once the road is built (during the first year after draining is complete) visitors would no longer have to hike down to the valley floor.

Just as described in the low development scenario, publicity surrounding the restoration would serve to educate the public leading to both “restoration tourism” and stimulating demand for recreation in the restored valley. The previously cited California Assembly Office report predicts that “if only transportation into the valley is provided, the visitation would be less [than if lodging is built], possibly **600,000 visitor-days per year** (1,650 per day, on average).” This is equivalent to about 300,000 individual visitors. This is consistent with Scott Gediman’s belief that a restored Hetch Hetchy would draw Yosemite Park visitors who are seeking a new experience, much like Tuolumne Meadows and Mariposa Grove are drawing more and more visitors. These visitors would not be replacing a Yosemite Valley trip, rather supplementing their

⁵⁷ Walsh, Richard. “An Economic Evaluation of the General Management Plan for Yosemite National Park” Colorado Water Resources Research Institute, Colorado State University, Technical Report No. 19, 1980.

⁵⁸ A 1998 Yosemite Area Regional Transportation Strategy Data Collection collected 7,430 surveys from park visitors. The results indicated approximately 10% visited Tuolumne Meadows and approximately 15% visited Mariposa Grove during their visit. Based on 2003 visitation levels, this would equal roughly 340,000 to 510,000 visitors to those areas. This is also consistent with on average daily visits to Tuolumne Meadows of 1,485 (for 7 months a year), from *Yosemite Valley Plan*, 2000.

⁵⁹ Interview with Yosemite National Park Chief of Media Relations, Scott Gediman, 5 April, 2004.

Park experience with something different.⁶⁰ It should be noted that Tuolumne Meadows draws 340,000 annual visitors despite being open only part of the year (in fall and winter the roads are closed for several months). Hetch Hetchy, much lower in elevation than Tuolumne Meadows, could remain open year round. Therefore, projecting 300,000 annual visitors based on Tuolumne Meadows is a rather conservative estimate.

In assessing the benefits of recreation to those who do visit the restored Hetch Hetchy Valley, Yosemite Valley is again the closest proxy. Individual willingness-to-pay for recreation in a more crowded Hetch Hetchy Valley would be lower than willingness-to-pay in the low development scenario. For ranges of individual willingness-to-pay, the medium development scenario falls between the low and high development scenarios.

It is unlikely that a high development scenario would evolve in Hetch Hetchy Valley given the environmental damage and great controversy caused by high levels of development in Yosemite Valley and current steps being taken to scale back development in Yosemite. Yet given the likelihood of great demand for visits to Hetch Hetchy, even preservation oriented restoration advocates might agree to improving and extending the road to the floor of Hetch Hetchy Valley.⁶¹

5.3.3 High Development

In the “high development” scenario, complete drainage would allow extensive construction on the Hetch Hetchy Valley floor. The road leading to Hetch Hetchy would be improved, and after the reservoir is drained and the dam removed, the road would be extended all the way into the valley and up the river canyon. Additional trails would be added on the valley floor and several prepared camp sites would be constructed. As in the low development scenario, while the valley is being drained and the dam is still in place, visitors could continue to walk on top of the dam. After drainage and dam removal are complete, an interpretive center and cafeteria could be added on the valley floor. However, it is infeasible that Hetch Hetchy Valley could contain the number of buildings and amenities that Yosemite Valley presently contains if only because Hetch Hetchy is much smaller (about 1/3 the length of Yosemite Valley). Thus, the Assembly Office of Research suggests that additional facilities could be built in the Poopenaut Valley (just downstream from Hetch Hetchy Valley) or on the road leading to Hetch Hetchy. Shuttle buses could service the valley floor, but according to existing studies, automobiles should probably be banned, even in the highest development scenario.⁶²

Existing analysis predicts that “if major, overnight visitor facilities are constructed and transportation into the valley is provided, [...] **Hetch Hetchy could handle approximately one million visitor-days per year** or about 2,700 per day on average. This would be about 15 percent of the 1987 visitor-days in Yosemite National Park.”⁶³ This is equivalent to about 500,000 individual visitors. Approximately 15 percent of Yosemite National Park visitors

⁶⁰ Interview with Yosemite National Park Chief of Media Relations, Scott Gediman, 5 April, 2004.

⁶¹ Interview with Ron Good, CEO of Restore Hetch Hetchy, 19 March 2004.

⁶² “Restoring Hetch Hetchy” prepared by the Assembly Office of Research, California State Legislature, No.0220-A, p. 27, June 1988.

⁶³ Ibid.

currently visit Mariposa Grove during their stay in the Park, so this prediction is consistent with the Yosemite officials' prediction that a restored Hetch Hetchy could become a significant, supplementary attraction within Yosemite National Park.

Individual willingness-to-pay for recreation in a more crowded Hetch Hetchy Valley would be lower than willingness-to-pay in the low or medium development scenario. For ranges of individual willingness-to-pay, the high development scenario falls at the low end of the range.

It should be noted that the high development scenario is the least likely of the scenarios to actually occur. Yosemite Valley ecosystems have been degraded by high level of development and visitation, and the Park Service has struggled mightily to roll back the development and reduce congestion in Yosemite Valley. Given an opportunity to develop another Yosemite-like valley it seems extremely unlikely that the Park Service would elect to repeat the mistakes of high development in Yosemite Valley. High development would also draw protest from other stake-holders, such as environmental groups. Residents of Tuolumne County, however, who stand to benefit from increased tourism to Hetch Hetchy⁶⁴ might prefer greater development.

⁶⁴ Gettleman, Elizabeth. "Yosemite's Other Valley: Hetch Hetchy Restoration and Its Potential Impact on Tuolumne County." Advanced Policy Analysis, Goldman School of Public Policy, U.C. Berkeley. 2003.

6 Benefits Estimates

Summary of Benefits Estimates

- Annual benefits resulting from the use of a restored Hetch Hetchy Valley range from \$14 to \$15.5 million for the low development scenario, to between \$17 and \$35 million for the high development scenario.
- Aggregate use value ranges between:
 - \$200 and \$600 million dollars for the low development scenario
 - \$150 and \$850 million dollars for the medium development scenario
 - \$247 million to \$1.4 billion for the high development scenario
- There is no data that matches the assumptions of the high development scenario; therefore, the medium development consumer surplus values were used to calculate the high development scenario. Because consumers are likely to have a lower individual willingness to pay for the high development scenario, this means that the use benefits for the high development scenario are very likely *overestimated*.
- Non-use estimates using the available data are unreliable as none of the data is for sites that are closely comparable to Hetch Hetchy. Based on existing WTP studies, it seems unlikely that the discounted present value of Americans' willingness-to-pay would be less than \$1 billion dollars.
- ED must have a reliable estimate of the non-use value associated with a restored Hetch Hetchy Valley in order to argue restoration benefits outweigh the costs.

All benefits are calculated assuming a 100 year time horizon and discount rates between 2% and 7%. Benefits are discounted, but not escalated to account for the increasing scarcity of natural, open spaces over time. If the appreciating value of natural resources over time were taken into account, benefits would likely be larger than the calculations in this analysis show. For a more detailed discussion of time horizons, discounting, and data, please see Appendices I and II.

6.1 Use Benefits Estimates

In calculating a range of estimates for non-use benefits, confidence intervals surrounding individual consumer surplus⁶⁵ estimates, as well as differing discount rates are taken into account. Results for the medium development scenario average consumer surplus are based on the most realistic, conservative set of assumptions: a medium level of development, visitation

⁶⁵ Individual consumer surplus = individual willingness to pay – individual cost of transport/entry, etc. This represents a net individual benefit, but it does not take into account the social costs of providing the resource being used.

analogous to Tuolumne Meadows, benefits based on average general recreation values. These assumptions result in a range of \$233 million to \$628 million in total present value recreation benefits, applying a discount rate of 7% and 2%, respectively. A mid-range discount value of 5% yields total present value recreation benefits of \$308 million dollars.

<i>Table 5: Restored Hetch Hetchy Valley Annual Visitation Projections</i>			
	Low-Dev	Medium-Dev	High-Dev
Visitor-days	400000	600000	1000000
Visitors	200000	300000	500000

(Source: Assembly Office of Research 1988)

<i>Table 6: Summary of Individual Consumer Surplus Per Visitor Day</i>									
	Low Dev. Lower Bound	Low Dev. Average	Low Dev. Upper Bound	Med. Dev. Lower Bound	Medium Dev. Average	Med. Dev. Upper Bound	High Dev. Lower Bound	High Dev. Average	High Dev. Upper Bound
CS/person/ activity day (\$2003)	\$34.69	\$36.70	\$38.72	\$17.35	\$26.12	\$34.90	\$17.35	\$26.12	\$34.90

(Source: Rosenberger and Loomis 2000)

<i>Table 7: Total Annual Consumer Surplus⁶⁶ in Millions of Dollars</i>			
Scenario	Lower Bound Total Annual	Average Total Annual	Upper Bound Total Annual
Low Dev	\$13.88	\$14.68	\$15.49
Medium Dev	\$10.41	\$15.67	\$20.94
High Dev	\$17.35	\$26.12	\$34.9

Consumer surplus for the low development scenario is based on West Coast wilderness recreation values given in a meta-analysis of recreation use values. General recreation values, which are slightly lower, are used for the medium development scenario. This confirms Walsh's conclusion that willingness to pay is higher in less crowded areas. No data for resources similar to a highly developed Hetch Hetchy Valley could be found.⁶⁷ Therefore, the same consumer surplus estimates that were used for the medium development scenario were also used to estimate high development benefits. One would expect, however, that individual willingness-to-pay would be lowest for a high development scenario. **Therefore, the benefits calculated for**

⁶⁶ Total Annual Consumer Surplus = (Individual Consumer Surplus per visitor day) * (Visitor-days Projected); Bounds calculated using confidence intervals given in Rosenberger & Loomis meta-analysis.

⁶⁷ For further discussion of data sources please see Appendix II of this report.

the high development scenario are very likely overestimated. There is insufficient data to say for sure how much less individuals would be willing-to-pay for a highly developed Hetch Hetchy Valley, but existing studies suggest that individual consumer surplus might decline by as much as 20% between a medium development and high development scenario.

Table 8: Total Gross Use Benefits, Based on Average Annual Benefits, Discounted Over 100 years at 5%

▲ Low Development Scenario	\$289 M
■ Medium Development Scenario	\$308 M
● High Development Scenario	\$514 M

Figure 5: Benefits Vary Greatly Depending on Choice of Discount Rate

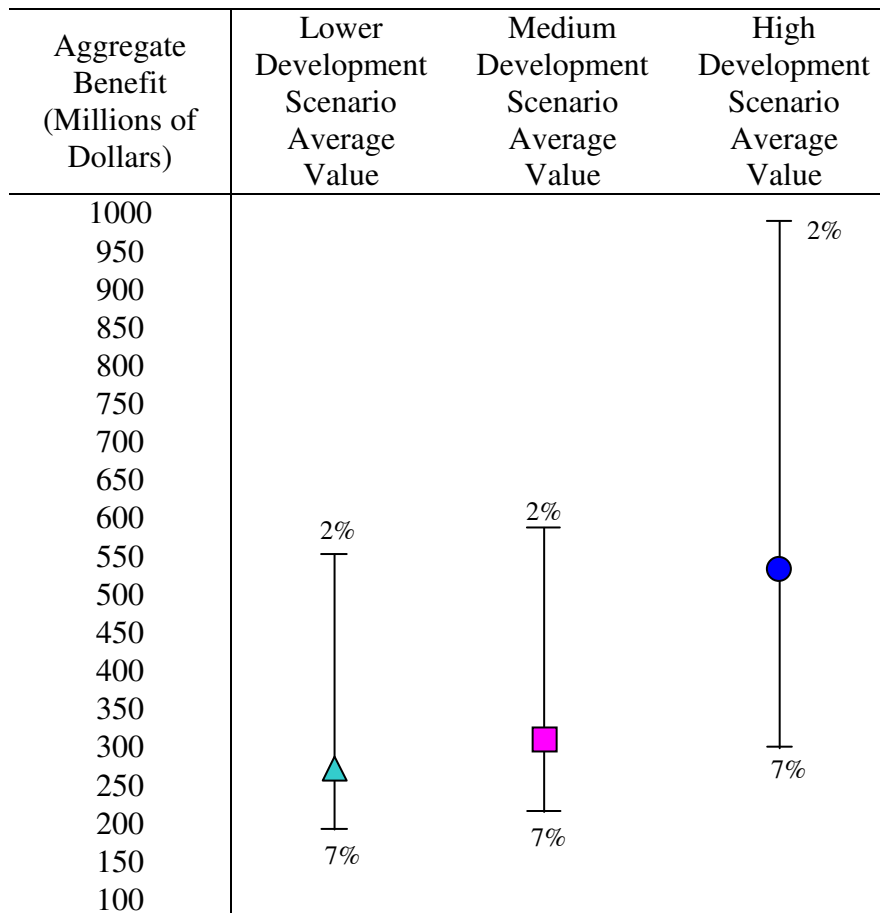


Table 9: Use Value
Summary of Aggregate Discounted Consumer Surplus Values in Millions of Dollars

	Low Dev. Lower Bound	Low- Dev Average	Low Dev. Upper Bound	Med. Dev. Lower Bound	Medium Dev. Average	Med. Dev. Upper Bound	High Dev. Lower Bound	High Dev. Average	High Dev. Upper Bound
Discounted Total - 2%	\$565	\$598	\$631	\$424	\$638	\$852	\$706	\$1,063	\$1,421
Discounted Total - 5%	\$273	\$289	\$305	\$205	\$308	\$412	\$342	\$514	\$687
Discounted Total - 7%	\$198	\$209	\$221	\$148	\$223	\$298	\$247	\$272	\$497

(Bounds calculated using confidence intervals given in Rosenberger & Loomis meta-analysis. Discounted over 100 years. All numbers rounded to the nearest million.)

6.2 Non-Use Benefits Estimates

Most existing data for non-use value data is for resources quite different from Hetch Hetchy; it is therefore not very useful in reliably calculating potential non-use benefits. It is difficult to equate the value individuals may place on a salmon river in Vermont and a scenic river valley in the Sierras. Rather than transferring the non-use benefits estimated for other sites in an attempt to estimate an actual number for Hetch Hetchy, the existing data serves best to offer a comparison value. For example, we can say that if Americans value Hetch Hetchy at least as much as they seem to value the White River in Vermont, we would expect an annual willingness-to-pay on the order of \$1.7 billion per year (\$24 to \$69 billion present value over 100 years depending on the discount rate).

*Table 10: Non-Use Data--
Annual Household WTP Estimates From Other Resources*

Median Annual WTP/HH for non-users to preserve White River in Vermont (\$2003)	Mean WTP/US HH for dam removal along Elwha ⁶⁸ (\$2003)	Median CA Annual WTP/HH for Mono Lake Restoration (\$2003)	Mean CA Annual WTP/HH for Mono Lake Restoration (\$2003)
\$17.19	\$80.22	\$88.52	\$101.08

Perhaps the closest available analogy would be Mono Lake. Located in California and the subject of a long, well publicized restoration campaign, it is an instructive example although it certainly differs from Hetch Hetchy Valley in critical ways. A contingent valuation study of Mono Lake was completed in 1993. The aim of the study was to find out what water level would Mono Lake have to be restored to in order to generate the greatest social benefits. A referendum survey of 600 California households was conducted, and photographs and drawings were used to illustrate the various water levels to which the lake could potentially be restored. Questions were asked regarding respondents annual willingness-to-pay (through state taxes) for a given water level. The water level that garnered the greatest willingness-to-pay was then recommended as the goal of the Mono Lake restoration plan.⁶⁹ This contingent valuation study yielded a median WTP of \$88.52 and a mean WTP of \$101.08 (in 2003 dollars). With 11.5 million households in California, this aggregate annual willingness to pay exceeds \$1 billion per year, using either the median or the mean estimates. If Californians were only half as willing-to-pay to restore Hetch Hetchy

Example: \$1 per household per year results in multi-billion dollar aggregate WTP

The existing data show us that an average annual willingness-to-pay of \$1 per household would be considered extremely low; yet if every household in America valued Hetch Hetchy's preservation at \$1 per year, the discounted present value would be anywhere from \$1.4 to \$4 billion depending on the choice of discount rate (assuming 100,000,000 U.S. households, discount 2-7% per year).

⁶⁸ Over a 10 year period, i.e. \$80.22 every year for 10 years.

⁶⁹ Mono Basin Draft Environmental Impact Report, Appendix X – Economics, 1993.

as Mono Lake, and assuming that annual willingness-to-pay extends for only 10 years (although benefits would actually extend for 100 years and beyond) aggregate discounted *willingness-to-pay would be \$4 to \$5 billion dollars for California residents alone*, depending on the choice of discount rate. Yet, Mono Lake is a salty in-land sea in a desert like setting, the main attractions of which are the migratory bird habitat and the unusual geological formations (known as tufa) in and near the lake, whereas Hetch Hetchy is monolith filled river valley in the high Sierras. While it is possible that these two resources may have similar non-use values, they cannot simply be equated for the purposes of this benefits transfer.

While it is extremely difficult to reliably estimate non-use value using the given data, the data do show us a range for the values individuals and households place on natural resources. The high potential non-use value Americans would place on a restored Hetch Hetchy is likely to be far larger than the potential use value. **If Environmental Defense hopes to argue that the benefits of restoring outweigh the costs, it must have a reliable estimate of the non-use value associated with a restored Hetch Hetchy Valley.**

For a more detailed discussion of the available data regarding non-use value, please see Appendix II of this report.

6.3 Another Perspective: National Park Land Acquisition Program

To put the estimates of use value into perspective, we can consider as a comparison the amount of money the National Park Service has spent on recent land acquisitions. The National Park Service spends hundreds of millions of dollars each year (\$1.4 billion in 2003) acquiring new land, and additional money restoring and preparing this land. National Park Service budget and planning documents show that the Park Service requested \$1.5 million dollars in FY '03 to purchase 77 acres of land to expand Point Reyes National Seashore, a price of roughly \$20,000 per acre. Budget requests for purchases to expand Grand Teton National Park by buying parts of a ranch adjacent to the Park are based on prices of roughly \$50,000 and \$88,000 per acre.⁷⁰ In both of these cases, scenic views and preservation value were cited as justifications for the budget requests. If these purchase values prices applied to Hetch Hetchy's 1,972 acres, the valley would be worth \$40 to \$180 million on the market, although it is conceivable that Hetchy Hetchy's 'market price' would be considerably higher. This is a crude proxy for assessing a restored Hetch Hetchy's potential value because the market does not provide an adequate mechanism for the expression of willingness-to-pay for public goods; however, these examples show that the National Park Service can and does spend hundreds of millions of dollars to buy land employed in other uses for the purpose of expanding existing national parks and thus benefiting the millions of citizens who visit them.

For a more detailed discussion of the available data regarding use value, please see Appendix II of this report.

⁷⁰ National Park Service, FY2003 Budget Justifications, available at http://data2.itc.nps.gov/budgetweb/fy2003/LASA_CLAPS.pdf

7 Potential Validity Concerns Associated With the Use of Benefits Transfer In This Case

Summary of Validity Concerns

- Uncertainty surrounding visitation projections threatens validity of the use value estimate.
- Existing non-use value data is for resources that are not quite comparable to Hetch Hetchy; valid non-use value estimates cannot be made using benefits transfer.

Secondary valuation methods were employed in this study in the hopes of calculating a reasonable estimate of potential benefits without having to mount an expensive research project. Benefits transfer is a tried and true technique for estimating the benefits associated with activities or assets that have been well studied in the past. In many cases, benefits transfer is the best tool for estimating benefits, particularly when original research is likely to yield similar estimates. A good benefits transfer study has three characteristics:

- 1) reliance on high quality studies;
- 2) consistency between resource to be valued and resource in the study, and
- 3) consistency between relevant populations evaluated.⁷¹

In this case, use values associated with a restored Hetch Hetchy can be estimated fairly well through benefits transfer. Many high quality studies have been published regarding recreation use values in parks and wilderness areas. Although Hetch Hetchy is unique, existing studies that evaluate a wide array of scenic outdoor areas, while not perfect proxies for Hetch Hetchy, are arguably comparable. Finally, this study uses data based on the evaluation of visitors to attractions in California and the Western States—arguably the same people who might visit a restored Hetch Hetchy. Based on the three criteria listed above, this study constitutes a reasonable employment of benefits transfer for the estimation of use values. However, **the difficulty and uncertainty of predicting visitation threatens the validity of the use value estimate.** Despite the realistic (some would argue conservative) assumptions regarding visitation, projections about visitation are uncertain at best. Yosemite National Park does not make visitation projections of any kind, even for known attractions such as Yosemite Valley, due to the uncertainty caused by the multiple factors influencing visitation. It would be impossible to carry out a benefits transfer study without making some assumptions regarding visitation, and other organizations, notably the California Assembly Office of Research, have made visitation projections; however, projecting visitation adds uncertainty to the estimates and makes them open to criticism from restoration opponents.

⁷¹ Black, Robert. et. al. “Economic Analysis for Hydropower Project Relicensing: Guidelines and Alternative Methods” Prepared for Division of Economics, U.S. Fish and Wildlife Service, USDOl, Chapter 6, October 1998.

There are two potential remedies to these short-comings, both involving more study. Professionals in the field of recreation science have sophisticated techniques for predicting visitation. A more complex model for the potential visitation to Hetch Hetchy could be developed. There is still uncertainty associated with any prediction; however, analysis by experts in the field may bolster the validity of visitation assumptions and make a benefits estimate based on such projections more valid in the eyes of critics. Another alternative would be to conduct an original contingent valuation survey regarding individuals' willingness-to-pay for recreation in a restored Hetch Hetchy Valley. This alternative is discussed in Section 8,

Existing non-use data are difficult to apply to Hetch Hetchy. Most of the available data concern valuations of rivers containing endangered fish species. Willingness-to-pay for the restoration of a threatened species' habitat may be quite different than willingness-to-pay to restore a scenic resource that does not involve important animal habitat. The closest comparable available case is Mono Lake, and yet Mono Lake differs significantly from Hetch Hetchy, both physically and geographically. Additionally, Mono Lake is a critical habitat for many species of migratory birds. **Although it is possible to use existing data to help contextualize the potential non-use value of a restored Hetch Hetchy, a reliable benefits estimate is not possible using benefits transfer techniques in this case.**

8 Recommendations

Summary of Recommendations

- Refocus the Hetch Hetchy Valley restoration debate toward a discussion of the potential economic benefits of restoration.
- Carry out original research to better estimate the benefits associated with restoring Hetch Hetchy.
 - An original contingent valuation survey of the willingness-to-pay associated with a restored Hetch Hetchy Valley is the preferred option for better estimating both use and non-use benefits.
 - Preliminary surveys gauging public awareness would be a good first step toward a contingent valuation survey.

8.1 Recommendation: Refocus the Hetch Hetchy Valley restoration debate toward a discussion of the potential economic benefits of restoration.

A review of the history and literature reveals the debate regarding Hetch Hetchy has focused almost entirely on the costs with very little analysis of the potential benefits of restoration. Environmental Defense needs to change the subject and get stakeholders talking about the real economic benefits of restoration—even if the exact amount of those benefits is uncertain. Unless a majority of stakeholders are convinced that those benefits do exist, and are potentially very large, the movement to restore Hetch Hetchy Valley stands little chance of success.

One reason that San Francisco has continually prevailed in the Hetch Hetchy debate is that from the beginning, whether or not true economic benefits exceeded true economic costs, San Francisco has succeeded in advancing its interests because those interests are concentrated and well organized. San Francisco speaks with a unified voice. The millions of people who may place real value on Hetch Hetchy's restoration are dispersed, unorganized, and no match for San Francisco even if the sum of their interests is greater than the City's. Environmental Defense, even if it does not or can not organize the masses, should at least start talking about the public's collective economic values.

8.2 Recommendation: Carry Out Original Research to Better Estimate the Benefits Associated With Restoring Hetch Hetchy

While this analysis suggests that benefits may potentially be quite large, the uncertainty surrounding non-use or “existence” value is too big to fix a reliable number for those benefits. This is important, as the net present discounted use value alone, although potentially several hundreds of millions of dollars, will probably be too small to off-set the potentially multi-billion dollar cost of re-operating the Hetch Hetchy system and finding alternative power sources for the City of San Francisco. **The only way that a restoration of Hetch Hetchy can be considered beneficial for society as a whole is if the benefits, both use and non-use together, outweigh the potential costs of restoration.** Environmental Defense could make a powerful argument in favor of restoration if it could show net economic benefits are likely to result. Historically, arguments for restoration based on moral or legal grounds have proven insufficient; this is not surprising given San Francisco’s large economic interest in the Hetch Hetchy water and power system. By showing that society will end up with a net gain, or conversely, by showing that San Francisco’s present benefits do not outweigh the cost to society of keeping Hetch Hetchy under water, Environmental Defense can counter opponent’s standard argument that restoration is not worth the cost.

8.2.1 Preferred Restoration Benefits Analysis Option: Original Contingent Valuation Survey

The ideal analysis would contain an original contingent valuation to assess individual willingness-to-pay for both the use and non-use value associated with a restored Hetch Hetchy Valley. Despite the controversy surrounding contingent valuation, it is a method employed by several agencies of the Federal government to evaluate the net benefits of a variety of public works and recreation projects. Although contingent valuation has flaws, this method can provide reliable and useful information in assessing the net benefits of natural resources. It is also, at present, the only tool available for the evaluation of non-use benefits. **Without an original contingent valuation survey to assess non-use value, it is likely that the benefits of restoration will be grossly underestimated.** Finally, while there are critics who will always doubt the reliability of economic benefit estimates based on contingent valuation, even critics must acknowledge that at the very least contingent valuation is a sophisticated tool for gauging not only the breadth, but also the intensity, of support for a given policy.

Developing an appropriate survey instrument is likely to take three to four months. Survey questions must be developed and tested, and most importantly, a payment vehicle scenario must be developed. In other words, the story of how respondents would pay needs to be thought through. In this case, it is fairly easy to take the same approach that the Mono Lake contingent valuation survey took by asking willingness to pay in terms of increased taxes.⁷² A thorough contingent valuation survey would sample from the San Francisco Bay Area, California, and the nation as a whole, particularly since any restoration would likely be paid for out of a

⁷² Appendix X – Economics, Mono Basin Draft EIR Appendices, available for download at <http://www.monobasinresearch.org/online-reports/deirap.htm>

combination of city, state, and Federal dollars. Conducting interviews would take 2-3 months, and an additional 2-3 months would be required to analyze and interpret the data. A contingent valuation survey could, in sum, take about a year to organize, implement, and analyze.⁷³

8.2.2 A First Step: Preliminary Surveys Can Determine Extent of Hetch Hetchy Awareness

Intermediate surveying could be done prior to a full scale contingent valuation survey. Preliminary surveys would assist in assessing how wide spread knowledge about Hetch Hetchy is, both at a California and a national level, and what steps are necessary to educate the public about Hetch Hetchy. Two possibilities for preliminary surveys include omni-bus telephone surveys and small focus groups. The Survey Research Center at U.C. Berkeley conducts omnibus telephone surveys including a wide array of questions several times a year. The survey is usually administered to a statistically balanced sample of 1000 Californians over the telephone. A question can be purchased on one of these surveys for approximately \$1,000. This would be an excellent vehicle for one to two simple questions to gauge awareness of Hetch Hetchy existence. Similarly, focus groups could help determine the depth of awareness regarding Hetch Hetchy. Focus groups could also serve as a preliminary testing ground for contingent valuation survey questions. If preliminary surveys and focus groups reveal low awareness of Hetch Hetchy and related issues, Environmental Defense may prefer to focus on raising public awareness rather than immediately focusing on a contingent valuation survey. If, however, awareness is moderate to high, Environmental Defense (or other organizations interested in the Hetch Hetchy issue) should proceed with a full scale benefits analysis involving a contingent valuation survey.

⁷³ Interview with Dr. Michael Hanemann, Professor of Agricultural and Resource Economics and leading contingent valuation expert at UC Berkeley, 3 May 2004.

Appendix I: Discussion of Time Horizon and Discounting

This analysis assumes a time horizon of 100 years. The use benefits will begin accruing as soon as the draining begins, because it is assumed that restoration in and of itself would draw visitors initially, which will be replaced by general recreation visitation in subsequent years. Adding weight to the assumption that use benefits could begin accruing to Hetch Hetchy before restoration is 100% complete, the California Assembly Office of Research notes in its analysis that “it is important to recognize that the aesthetic value of the valley is primarily the perspective of the meadows, the high polished-granite walls, and the waterfalls. The trees clearly add to the aesthetics, but they don’t have to be 100 years old.”⁷⁴ Any benefits with a time horizon greater than 100 years are unlikely to be significant when discounted to the present.

Social discount rates reflect society’s tradeoff for present vs. future consumption. Social discount rates are generally lower than private discount rates based on investment. The recommended range of discount rates for public investment projects is 2-7%.⁷⁵ Furthermore, most of the existing literature on this topic, including all of the recent studies by Loomis, Walsh, and other prominent researchers in this field, has used a range of 2-7%. Hyperbolic discounting (time-declining discount rates) is useful for long-term, intergenerational environmental benefits. This method would give greater weight to long-term benefits (and less weight to near term benefits) than standard discounting. There is, however, some dispute over how time-declining social discount rates should be used and hyperbolic discounting has not become standard practice.⁷⁶

None of the benefits in this analysis were escalated over time to reflect the increasing scarcity of finite open spaces as the population expands. This, however, is a valid concern and failure to escalate benefits may lead to an underestimation of benefits. Because estimating the rate at which the value of open spaces may escalate is difficult and time consuming, this analysis errs on the side of underestimating benefits. A full scale cost-benefit-analysis, however, should take this into account.

⁷⁴ “Restoring Hetch Hetchy” prepared by the Assembly Office of Research, California State Legislature, No.0220-A, p. 27, June 1988.

⁷⁵ Office of Management and Budget Guidelines and Discount Rates for Benefit Cost Analysis of Federal Programs

⁷⁶ Boardman, et. al. Cost-Benefit Analysis: Concepts and Practice Second Edition, 2001, p. 247-248.

Appendix II: Discussion of Data Used in Benefits Calculations

Summary of Use Value Data

- Use value estimates are based on recreation values specific to the California region from the Rosenberger and Loomis meta-analysis.
 - For the low development scenario, the average consumer surplus values for wilderness recreation (\$31.29 [in 4th quarter 1996 dollars]) are used to estimate use benefits. The range of values for the low-development scenario is calculated using the confidence interval around this estimate.
 - For the medium development scenario the average value for general recreation (\$22.27 [in 4th quarter 1996 dollars]) is used to estimate use benefits. The edges of the confidence interval for this estimate are used to calculate a range of values.
 - For the high development scenario the average value for general recreation (\$22.27 [in 4th quarter 1996 dollars]) is used to estimate use benefits, as no “high development” proxy estimate can be found.

Summary of Non-Use Value Data

- No resource valued in the data given resembles Hetch Hetchy closely enough to give a reliable estimate of non-use value. However, available data can help contextualize the potential non-use value of Hetch Hetchy Valley.
 - Resources that seem likely to be less valuable than a restored Hetch Hetchy Valley can be used to estimate a possible lower bound.
 - An upper bound estimate is difficult to estimate because existing resources that have been valued are not comparable enough to Hetch Hetchy Valley to say definitively if they are “more valuable” and therefore constitute an upper bound.

Appendix II – Section 1: Use Value Data

There is a wealth of existing value for use in benefits transfers relating to recreation values in parks, wildlife areas, and other natural settings. John Loomis, (this description should come when he's first mentioned) Professor, Department of Agricultural and Resource Economics at Colorado State has contributed greatly to the published literature regarding economic use and non-use benefits relating to natural resources, including comprehensive cost-benefit analysis of a dam removal project in Washington state and a meta-analysis of use value benefits for recreation. Table 11 shows summary statistics on average consumer surplus values per activity day per person from recreation demand studies—1967 to 1998 in 1996 dollars, taken from a report by Rosenberger⁷⁷ and Loomis completed for the U.S. Forest Service.⁷⁸

Table 11: Meta-Analysis of Consumer Surplus Values Associated with Outdoor Recreation (fourth-quarter, 1996 dollars)

Activity	Number of studies	Number of Estimates	Mean of estimates	Median of Estimates	Std. Error	Range of Estimates	
Camping	22	40	\$30.36	\$24.09	5.5	\$1.69	– \$187.11
Picnicking	7	12	35.26	24.21	9.66	7.45	– 118.95
Swimming	9	12	21.08	18.19	4.46	1.83	– 49.08
Sightseeing	9	20	35.88	21.13	9.41	0.54	– 174.81
Non-motor boating	13	19	61.57	36.42	13.76	15.04	– 263.68
Hiking	17	29	36.63	23.21	7.87	1.56	– 218.37
Biking	3	5	45.15	54.9	8.4	17.61	– 62.88
Cross-country skiing	7	12	26.15	26.73	2.84	11.7	– 40.32
Big game hunting	35	177	43.17	37.3	2.21	4.74	– 209.08
Small game hunting	11	19	35.7	27.71	9.56	3.47	– 190.17
Waterfowl hunting	13	59	31.61	18.21	4.06	2.16	– 142.82
Fishing (all types)	39	122	35.89	20.19	3.42	1.73	– 210.94
Wildlife viewing	16	157	30.67	28.26	1.38	2.36	– 161.59
Rock climbing	2	4	52.96	48.14	11.8	29.82	– 85.74
General recreation	12	31	24.26	10.03	7.48	1.18	– 214.59
Other recreation	11	16	40.58	33.78	9.64	4.76	– 172.34

(Source: Rosenberger and Loomis 2000)

⁷⁷ Randall S. Rosenberger is Assistant Professor, Regional Research Institute and Division of Resource Management, at West Virginia University

⁷⁸ Rosenberger, Randall S.; Loomis, John B. 2001. Benefit transfer of outdoor recreation use values: A technical document supporting the Forest Service Strategic Plan (2000 revision). Gen. Tech. Rep. RMRS-GTR-72. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 59 p.

Table 11 encompasses all recreation activities that could conceivably be carried out in a restored Hetch Hetchy Valley. The data analyzed used both travel cost and contingent valuation methods to estimate benefits. Table 12 shows how wide the range of values for various activities can be. Willingness-to-pay may be extremely high. Rosenberger and Loomis also provide a table of values specific to various regions, including the Forest Service's Pacific region (California, Oregon, and Washington).

*Table 12: Recreation Consumer Surplus Values for the USDA Forest Service's Pacific Region
(fourth-quarter, 1996 dollars)*

Activity	n	Mean	Median	Std. Error	95% Confidence Interval
Camping	4	\$86.96	\$77.27	5.5	\$81.46 - \$92.46
Picnicking	3	53.52	28.95	9.66	\$43.86 - \$63.18
Swimming	4	22.74	18.41	4.46	\$18.28 - \$27.20
Sightseeing	1	50.64	50.64	9.41	\$41.23 - \$60.05
Off-road diving	1	33.64	33.64	6.27	\$27.37 - \$39.91
Motor boating	4	21.69	11.48	11.65	\$10.04 - \$33.34
Hiking	14	26.71	22.87	7.87	\$18.84 - \$34.58
Downhill skiing	1	20.9	20.9	7.07	\$13.83 - \$27.97
Cross-country skiing	1	40.32	40.32	2.84	\$37.48 - \$43.16
Big game hunting	12	40.76	29.42	2.21	\$38.55 - \$42.97
Small game hunting	1	27.37	27.37	9.56	\$17.81 - \$36.93
Waterfowl hunting	5	33.19	30.82	4.06	\$29.13 - \$37.25
Fishing	15	36.97	22.41	3.42	\$33.55 - \$40.39
Wildlife viewing	15	29.74	31.65	1.38	\$28.36 - \$31.12
General recreation	2	22.27	22.27	7.48	\$14.79 - \$29.75
Other recreation	1	62.06	62.06	9.64	\$52.42 - \$71.70
Wilderness ⁷⁹ recreation	13	31.29	22.53	1.72	\$29.57 - \$33.01
Total # cases (N)	84				

(Source: Rosenberger and Loomis 2000)

In determining how to apply these data to a benefits transfer for recreation value of a restored Hetch Hetchy Valley, it would be inappropriate to estimate total benefits by summing up the

⁷⁹ Confidence Interval not included in original report; contacted John Loomis directly for guidance and data to calculate confidence interval.

benefits of various recreation activities. Although sight-seeing, picnicking, and camping are all evaluated separately in the previous tables, doing all of those things at once in Hetch Hetchy Valley may not be the sum of estimates, as willingness-to-pay for jointly provided goods may be different from willingness-to-pay for separately provided goods. Therefore, it may be more appropriate to use values for general recreation or wilderness recreation. Wilderness recreation applies specifically to recreation in designated “wilderness areas” within National Forests and may therefore be appropriate for use in estimating recreation benefits for the low-development scenario. General recreation, as the name implies, is based on data regarding recreation more broadly. Considering the high value that many people place on recreation in Yosemite National Park in particular, this is a conservative approach.

Examining the California specific studies that Loomis and Rosenberger analyzed, we find one particularly interesting study focusing on willingness-to-pay for back-country hiking within California. Using a zonal travel cost method and a nested Poisson approach to evaluate willingness-to-pay for access to Forest Service Wilderness Areas, the authors found the following levels of consumer surplus associated with travel to designated areas:

<i>Table 13: Consumer Surplus Associated With Back Country Hiking in California⁸⁰ (fourth quarter 1996 dollars)</i>	
Area	Consumer Surplus (\$1996)
Golden Trout Wilderness Area (Inyo National Forest)	\$9.86
Lassen Volcanic National Park back country	\$11.33
Sequoia & Kings Canyon National Park back country	\$14.63
Hoover Wilderness Area	\$22.53
<i>Ansel Adams Wilderness Area (Inyo National Forest)</i>	<i>\$27.07</i>
John Muir Wilderness Area (Inyo National Forest)	\$29.53
Aggregate	\$25.24

(Source: Baker 1996 cited in Loomis and Rosenberger 2000)

John Muir Wilderness includes Mount Whitney, the tallest peak in the lower 48 states. Both the John Muir Wilderness and the Ansel Adams Wilderness have limited permits (quotas) during the summer months. It is not surprising that these two areas are associated with the largest consumer

⁸⁰ Rosenberger, Randall S.; Loomis, John B. 2001. Benefit transfer of outdoor recreation use values: A technical document supporting the Forest Service Strategic Plan (2000 revision). Gen. Tech. Rep. RMRS-GTR-72. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 59 p. (Original Source Cited: Baker, J.C. “A nested Poisson approach to ecosystem valuation: an application to backcountry hiking in California.” Reno, NV: University of Nevada, Reno. 26 p. 1996.)

surplus, given the limited access and iconic nature of these two areas. The John Muir Wilderness is the most visited National Forest Wilderness Area in the lower 48 states, no doubt due to the presence of Mount Whitney. The permit quotas and lottery system for permits to climb Mount Whitney suggests demand for visits to both the Muir and Adams Wilderness Areas exceeds supply. The study of back country hiking in California, and particularly the results for the John Muir Wilderness and the Ansel Adams Wilderness may be useful in estimating the consumer surplus associated with visits to a restored, less developed Hetch Hetchy.

Three studies contain general recreation data for California specifically. None of the studies evaluating general recreation give a location more specific than California in general. One study gives a consumer surplus for general recreation within the Forest Service's California region (FS5, RPA4) of \$43.35 using individual travel cost.⁸¹ Another study gives a low consumer surplus value of \$1.18; this study estimated the value of alternative outdoor recreation facilities within a small area, suggesting that this is a closer estimate of the consumer surplus of additional facilities in a highly developed area.⁸² Finally, the same study that estimated \$4.22 for California wilderness consumer surplus gives \$10.03 for general recreation in National Forest areas within California. This is the only result in the literature that shows a general recreation value that is greater than the wilderness value for the same area. The same study estimates wilderness values to be greater than general recreation values for every other Forest Service region evaluated.⁸³

⁸¹ Rosenberger and Loomis, reference number 9: Barrick, 1986.

⁸² Rosenberger and Loomis, reference number 111: Moncur, 1975.

⁸³ Rosenberger and Loomis, reference number 101: McCollum, et. al. 1990.

Table 14: Breakdown of Consumer Surplus Estimates Potentially Applicable to Hetch Hetchy

Source	Description	Method	Amount	Possible Application	Pro/Con
Loomis 1996	Meta-analysis average value for wilderness rec. in Pacific Region	Various	\$31.29	CS associated with low development scenario.	Average value—statistically robust, but not specific.
Baker 1996	CS for back country recreation in California; 6 locations evaluated	Zonal TC	\$25.24 aggregate	CS associated with low development scenario; can use range of values estimated in study.	Not a proxy for Hetchy, but is specific to relatively famous wilderness areas.
Loomis 1996	Meta-analysis average value for general recreation in Pacific Region	Various	\$22.27	CS associated with medium/high development.	Average value—in this case, no good proxies for Hetchy, average value may be best option.
Barrick 1986	CS for general rec. within Forest Service's California region	Individual TC	\$43.35		No area given; cannot tell what level of development this estimate most closely approximates. High end.
Moncur 1975	Value of alternative outdoor recreation facilities within a small area.	Zonal TC	\$1.18	(Additional) CS associated with high development.	As a stand-alone CS seems unusually low compared to other values, but is in line with Walsh's low WTP for crowded Yosemite.
McCollum 1990	Value of general rec. across several Forest Service Regions (including CA)	Zonal TC	\$10.03		No area given; cannot tell what level of development this estimate most closely approximates

Rosenberger and Loomis note that it is common practice for Federal land management agencies to use approved average values for estimating benefits in such cases.⁸⁴ While it seems rather a blunt instrument to use an average value, particularly given Hetch Hetchy's uniqueness and assumptions regarding theoretical willingness-to-pay, an examination of the data used in the Loomis meta-analysis shows that few of the studies examine areas that are natural proxies for Hetch Hetchy. Even the Baker study does not evaluate sites that can be closely approximated to Hetch Hetchy.

Appendix II – Section 2: Non-Use Value Data

The available data regarding non-use value is not summarized neatly into a single meta-analysis. While it seems plausible and even conservative to base willingness-to-pay for recreation in Hetch Hetchy Valley on a thorough meta-analysis of recreation use values, transferring non-use benefits from other sources is much trickier. The various estimates of non-use value that may be applicable in this case are wide ranging, and some of the resources valued are quite different from Hetch Hetchy.

Perhaps the closest available analogy would be Mono Lake. Located in California and the subject of a long, well publicized restoration campaign, it is an instructive example although it certainly differs from Hetch Hetchy Valley in critical ways. A contingent valuation study of Mono Lake was completed in 1993. The aim of the study was to find out what water level would Mono Lake have to be restored to in order to generate the greatest social benefits. A referendum survey of 600 California households was conducted, and photographs and drawings were used to illustrate the various water levels to which the lake could potentially be restored. Questions were asked regarding respondents annual willingness-to-pay (through state taxes) for a given water level. The water level that garnered the greatest willingness-to-pay was then recommended as the goal of the Mono Lake restoration plan.⁸⁵ This contingent valuation study yielded a median WTP of \$88.52 and a mean WTP of \$101.08 (in 2003 dollars).

Two particularly useful cost-benefit studies concern willingness-to-pay for dam removal. In 1996, Loomis found a willingness-to-pay of between \$59 and \$73 per household for the removal of the Elwha and Glines Canyon dams along the Elwha River in Washington State. The majority of the Elwha River flows through Olympic National Park. The dams along the river significantly impede the spawning of salmon and steelhead. Because of this, the dams attracted attention from environmental groups, who argued that the dams should be dismantled despite 172 GWH of power generated by the dams. The power the dams generate partially powers the pulp and paper mill that owns the dams. Loomis conducted a cost-benefit analysis employing

⁸⁴ Rosenberger, Randall S.; Loomis, John B. 2001. **Benefit transfer of outdoor recreation use values: A technical document supporting the Forest Service Strategic Plan (2000 revision)**. Gen. Tech. Rep. RMRS-GTR-72. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 59 p.

⁸⁵ Mono Basin Draft Environmental Impact Report, Appendix X – Economics, 1993.

contingent valuation to estimate willingness-to-pay. Total benefits were presumed to accrue of 10 years. His findings are summarized in Table 15.⁸⁶

<i>Table 15: WTP for Dam Removal Along the Elwha River in Washington State</i>			
Respondent Group	Mean Annual WTP per Household (\$1996)	Aggregate Annual WTP (\$1996)	
		Low	High
Clallam County	\$59	\$94 million (all of	\$138 million (all of
Washington State	\$73	Washington)	Washington)
U.S.	\$68	\$3.376 billion	\$6.137 billion
	TOTAL:	\$3.47 billion	\$6.275 billion

(Source: Loomis 1996)

The study ultimately found that the present value of benefits of Washington State residents alone exceeded the present costs of removing the dams, even using lower bound estimates for benefits and upper bound estimates for costs.

Similarly, a study of the removal of Newport No. 11 Diversion Dam on the Clyde River near Newport, Vermont found a mean annual willingness-to-pay of \$67 for residents of the county in which the dam was located, and a mean annual willingness-to-pay of \$52 for the rest of Vermont. The study used a contingent valuation survey that asked respondents what they would contribute annually to a trust fund set up for dam removal.⁸⁷ The Clyde River, it should be noted, is a river to which Atlantic salmon are native; salmon eventually returned to the portion of the Clyde previously impeded by the Newport Dam.

Because the Elwha and Newport studies involved fish, some part of the non-use value is theoretically related to the value individuals place on restoring a species to its native habitat. The dam removal studies are potentially quite relevant, but because of the unknown value that preservation of fish species adds to the total non-use value in those cases, they are not perfect candidates for benefits transfer.

In addition to the dam removal studies, several studies regarding willingness-to-pay to improve or preserve river flows are summarized in a Department of Interior guide to the economic analysis of dam projects.⁸⁸ The DoI report summarizes the various studies' conclusions regarding non use value; values range from \$15 to \$59 (\$1997) willingness-to-pay on the part of non-users. Table 6 replicates the table in the DoI report.

⁸⁶ Loomis, John B. "Measuring the Economic Benefits of Removing Dams and Restoring the Elwha River: Results of a Contingent Valuation Survey," Water Resources Research, Vol.32, No. 2, pp. 441-447, February 1996.

⁸⁷ Black, et. al. "Economic Analysis for Hydropower Project Relicensing: Guidance and Alternative Methods" Prepared for Division of Economics, US Fish and Wildlife Service, Department of the Interior, by Industrial Economics, Inc. 1998

⁸⁸ Black, et. al. "Economic Analysis for Hydropower Project Relicensing: Guidance and Alternative Methods" Prepared for Division of Economics, US Fish and Wildlife Service, Department of the Interior, by Industrial Economics, Inc. 1998.

Table 16: Summary of Willingness-to-pay for Improvement or Preservation of River Flows

Study	Resource Valued	Survey Type	Population	Annual WTP per Household (\$1997)
Clonts and Malone; 1990	Preservation of Flows in 15 Alabama Rivers	Telephone	River Users	\$96
			Non-Users	\$59
Sanders et. al., 1990	Designations as Wild and Scenic of up to 11 Colorado Rivers	Mail	1 River	\$27
			3 Colorado Households	\$60
			11 Rivers	\$175
Berrens et. al.	Minimum Instream Flows in all New Mexico Rivers (to protect fish species)	Telephone	New Mexico Households (first estimate is to preserve one fish in one river, second is to preserve 11 fish species on all NM rivers)	\$30
				\$94
White River Valuation Study, 1998	Preventing Hydro Development on White River in Vermont	Mail	White River Households	\$52
			Other VT Households	\$19
			Non-use White River	\$19
Welsh, et. al. 1995	Reducing Flow Fluctuations on the Colorado River, Glen Canyon Dam	Mail and Telephone	Non-use other	\$15
			U.S. Households	\$21
			Salt Lake City Households	\$30

(Source: Black/DoI 1998)

More generally, there are estimates of non-use values for land or wilderness in general. In addition to his analyses of recreation values and the dam removal study already discussed, the prolific and authoritative Loomis has published numerous papers regarding non-use value of natural resources. Below is data from a table Loomis created using Walsh's 1982 and 1984 studies regarding willingness-to-pay for various levels of land preservation in the state of Colorado. The last row includes the per acre net present willingness-to-pay of both Coloradans and non-Coloradans. Loomis comments:

This is probably a conservative estimate of what non-Colorado residents would pay for wilderness, as Colorado residents had more than a million acres of wilderness at the time of the survey. The majority of the U.S. population in the east and Midwest have little

wilderness, so an additional acre of wilderness is probably worth more to them than to Colorado residents.⁸⁹

<i>Table 17: Recreation and passive use values of wilderness in Colorado.</i>				
	Scenario 1	Scenario 2	Scenario 3	Scenario 4
millions of acres	1.2	2.6	5	10
Total passive use per household	\$13.92	\$18.75	\$25.30	\$31.83
Total for CO (millions of 1980 dollars)	\$15.3	\$20.6	\$27.8	\$35.0
Recreation	\$13.2	\$21.0	\$33.1	\$58.2
Total economic value for Colorado (millions)	\$28.5	\$41.6	\$60.	\$93.2
Percent passive use	54%	50%	46%	38%
Marginal present value per acre to Colorado and U.S. residents	\$1,246	\$320	\$220	\$220

(Source: Walsh et. al., 1982, 1984)⁹⁰

Note also that, as previously suggested in the economic analysis section of this report, the analysis of Loomis and Walsh confirms that non-use value can exceed use value.

Additionally, Loomis cites a 1986 study by Barrick that concerning the Washakie Wilderness area in Wyoming, estimated non-use values of \$14.60 and \$12.70 (\$1996) for urban and rural U.S. residents respectively.⁹¹ Using existing studies by Walsh, Barrick, and others, and applying a discount rate of 7.375%, Loomis calculates a present value of non-use benefits of \$168 per acre for wilderness land in general in the western half of the lower 48 states.⁹² He is careful to note that this is a rough estimate and should be refined with further study.

Reinforcing the notion that non-use value for Hetch Hetchy might be quite high, Aaron J. Douglas, Economist with the U.S. Geological Survey notes that since most of America's rivers were dammed "all at once", the marginal value of removing even one dam on one river is very

⁸⁹ Loomis, John B. "Economic Values of Wilderness Recreation and Passive Use: What We Think We Know at the Beginning of the 21st Century" USDA Forest Service Proceedings RMRS-P-15-VOL-2. 2000

⁹⁰ Loomis created the table by combining data from two Walsh studies.

⁹¹ Ibid.

⁹² Ibid.

high. He also observes that the system of rivers of which the Tuolumne River is a part has been greatly affected by dams, reservoirs, and human development so restoring any portion of a river in the system would have a very high value.⁹³

⁹³ Interview with Aaron J. Douglas, Economics, USGS, 2 April 2004.

Appendix III: History of the Hetch Hetchy Damming and Restoration Controversy

Damming Hetch Hetchy: The first major clash of developers and conservationists.

San Francisco is located on a dry peninsula which, although surrounded by salt water, has few sources of fresh water. As the City grew up from a dusty pueblo and sparsely populated mission to a booming city of 80,000 by 1860, the water supply available on the peninsula became increasingly stressed. According to a history of the Hetch Hetchy water system published by the City of San Francisco, “Far sighted civic leaders began to realize that the only satisfactory solution to the problem was municipal ownership of assured water sources. [...] The decision was made—San Francisco must look beyond the Coast Range for a future water supply, to the Sierra Nevada along California’s eastern border.”⁹⁴ As early as 1882, engineers had recognized the Hetch Hetchy Valley as a potential damming point for the Tuolumne River.⁹⁵ By 1901, the City had compiled a list of possible water sources including Lake Tahoe, and most of the rivers of northern California, but the Tuolumne was already emerging as a favorite of San Francisco engineers and the mayor, James Phelan. While the City long had its sights set on Hetch Hetchy Valley, and maneuvered to begin acquiring water rights in 1901, it was not until 1906 that the debate began in earnest.⁹⁶

According to historian Roderick Nash, “Given the flourishing cult of wilderness on the one hand and the strength of traditional assumptions about the desirability of putting underdeveloped natural resources to use on the other, the battle over Hetch Hetchy was bound to be bitter. [...] The principle of preserving the wilderness was put to the test. For the first time in the American experience the competing claims of wilderness and civilization to a specific area received a thorough hearing before a national audience.”⁹⁷ By the early 1900’s, America had a strong naturalist movement, and Congress had already authorized the creation of National Parks for the sake of conservation and preservation of the American wilderness. John Muir was a well-respected naturalist who not only founded and led the Sierra Club, but was active in conservation politics. Muir camped with Theodore Roosevelt in Yosemite National Park, served as an advisor to the Federal Forestry Commission, and visited and spoke in Washington, D.C. regularly. Of the City’s plan to build a reservoir in Yosemite National Park, Muir famously said “Dam Hetch Hetchy! As well dam for water tanks the people’s cathedrals and churches, for no holier temple has ever been consecrated by the heart of man!” While respected and influential, Muir represented only one side of the debate. Gifford Pinchot, Chief Forester of the United States and an advocate of “wise use” policies, wrote in a letter to the President in 1907 “...I believe that the highest possible use which could be made of [Yosemite National Park] would be to supply pure water to a great center of population.”⁹⁸

⁹⁴ “Hetch Hetchy Water and Power: A History of the Municipal Water Department and Hetch Hetchy System” City and County of San Francisco, p. 23, Fifth Printing, 2002.

⁹⁵ Nash, Roderick. “Wilderness in the American Mind” Yale University Press, Third Edition, p. 161, 1982.

⁹⁶ “Hetch Hetchy Water and Power: A History of the Municipal Water Department and Hetch Hetchy System” p. 23.

⁹⁷ Nash, p. 162.

⁹⁸ Ibid.

The debate took place on a national scale. Because Hetch Hetchy Valley was and is in a National Park, and because Muir's opposition gave prominence to the discussion, the issue was to be ultimately resolved by Congress. San Francisco also sought to have its water rights to Hetch Hetchy Valley guaranteed by an act of Congress, rather than be subject to the control of the Interior Department and therefore vulnerable to the politics of succeeding administrations. The Sierra Club and other organizations sprang into action to print pamphlets for national distribution educating the public about the issue. Preservationists also campaigned for and got editorial support from most of the nation's major newspapers. Thousands of letters poured into Congress and the White House. President Roosevelt rescinded his previous support for the reservoir and said that the National Parks "should be kept as a great national playground. In both [Yellowstone and Yosemite], all wild things should be protected and scenery kept wholly unmarred." The Congressional Committee on Public Lands had narrowly approved granting Hetch Hetchy to San Francisco, but "a strong minority report dissented on the grounds that such action would deny the public's right to the valley for recreational purposes". The report noted "there has been an exceedingly widespread, earnest, and vigorous protest voiced by scientists, naturalists, mountain climbers, travelers, and others in person, by letters, and telegrams, and in newspaper and magazine articles." Not everyone was swayed by the protests, however. The San Francisco Chronicle referred to preservationists as "hoggish and mushy esthetes" and San Francisco's Chief Engineer wrote that the opposition was largely composed of "short-haired women and long-haired men."⁹⁹ The battle was to continue.

San Francisco was not successful in 1909, but pressed the issue again in 1913. The same forces were at play. Again, editorial boards across the country expressed the public's opposition. In 1913, no less than six "thunderous editorials" appeared in the New York Times urging President Woodrow Wilson to prevent Hetch Hetchy's damming and describing San Francisco's scheme as "sordid".¹⁰⁰ The Army Corps of Engineers supported the project, however, and a prominent University of California Geology and Mineralogy professor asserted that "The new lake will seem very natural in its natural setting."¹⁰¹ By arguing that a scenic lake would be created, and by organizing the key support of Senators from several western states, San Francisco began building Congressional momentum in favor of the reservoir. Furthermore, the City argued that the water was needed by the people of San Francisco for health and sanitation, which must necessarily outweigh any other use. On September 3, 1913 the "Hetch Hetchy Act" now popularly known as the "Raker Act", after Representative John Raker of Manteca who introduced the bill, was passed in the House under the leadership of William Kent, who would later donate the land that became Muir Woods National Monument. Kent's support and leadership was crucial since he had credibility as a California resident and avowed nature lover. Three months later, on December 2nd, after strong opposition and great debate, the act passed the Senate and went on to be passed by Woodrow Wilson.

⁹⁹ Ibid.

¹⁰⁰ The New York Times, Editorial, Saturday, October 19th, 2002.

¹⁰¹ "Hetch Hetchy Water and Power: A History of the Municipal Water Department and Hetch Hetchy System" p. 26.

Key Elements of the Raker Act

The Raker Act guarantees San Francisco's right to use Hetch Hetchy as a reservoir and requires the City to pay \$30,000 per year as a rental fee. This is around \$82 per day, which many have wryly observed would not be enough to get a room at the posh Awahnee Hotel on the floor of Yosemite Valley, or even a room at some of the motels near the Park's entrance. On a per acre basis, that amounts to 7 cents per acre for 417,000 acres of Federal watershed in the Sierra. In addition, San Francisco pays \$1.4 million per year to Yosemite National Park for programs to protect the water shed that feeds water into the Tuolumne River.¹⁰² In effect, San Francisco gets its water for free and pays only for the maintenance of the watershed and the cost of piping the water from the Sierra Nevada to the City itself.

No Cost-Benefit Analysis of Hetch Hetchy Reservoir Ever Done

In the early 1900's, cost-benefit analysis had not been developed as a tool; in fact, the science of modern economics was still in its infancy. As such, no one ever suggested or attempted to quantify the true economic costs and benefits of creating a reservoir on the Tuolumne at Hetch Hetchy Valley. Furthermore, although some other sites were briefly considered by city engineers, there is no record of side-by-side analysis of alternative sites. The economic costs and benefits to the City of San Francisco were discussed and analyzed, but the City viewed its annexation of Hetch Hetchy Valley as essentially "costless"; particularly since the land was in a National Park it was viewed as "free". Rather than a systematic analysis of alternatives with full consideration given to use and non-use values of Hetch Hetchy Valley and other potential sites, the Raker Act was passed as the culmination of years of political campaigning and maneuvering on the part of the City of San Francisco.

An extensive review of the literature reveals that no one has ever systematically analyzed the full costs and benefits of building and/or removing the dam at Hetch Hetchy Valley. A 1936 study completed by General Manager and Chief Engineer of the Water Department of San Francisco, N.A. Eckart, analyzed the benefits accruing to the City of San Francisco as a result of the Hetch Hetchy water system, including increased water purity and revenues from the sale of water and electricity. This study, however, did not consider benefits or costs outside of San Francisco, e.g. to U.S. taxpayers.¹⁰³ Around the time that Secretary of the Interior Don Hodel proposed studying the idea of restoring Hetch Hetchy in 1988, several preliminary documents were prepared by Federal agencies. The Bureau of Reclamation created a preliminary analysis of alternatives for water storage and power should Hetch Hetchy be restored, but the document does not constitute a full-blown feasibility analysis or cost-benefit study. The report acknowledges that there would be long-term environmental benefits to restoring Hetch Hetchy Valley, but does not make any attempt to quantify these, or any other, benefits of restoration. The same year, the Department of Energy reviewed and analyzed the alternatives suggested in the Bureau of Reclamation's report. The DoE analysis stated "primary benefits derived from a restored Hetch Hetchy Valley will be intangible in nature" and therefore, the study made no attempt to quantify the benefits of restoration, stating simply "from the average individual's perspective, the

¹⁰² "Hetch Kvetch" The Sacramento Bee, Sunday, February 8th, 2004.

¹⁰³ N.A. Eckart. "Benefits Accruing from the Hetch Hetchy Project, San Francisco Water Supply" Journal of the American Water Works Association, Vol. 28, No. 9, September, 1936.

anticipated total resource values of the reclaimed Hetch Hetchy Valley do not appear to be substantially higher than those that presently exist.” However, the report presented no evidence or analysis to support the assertion that the “average individual” values a restored Hetch Hetchy less than a dammed Hetch Hetchy; nor did the DoE report made no attempt to calculate recreation benefits (use value) for a restored Hetch Hetchy Valley, although this would clearly constitute a “tangible benefit” of restoration. The implicit assumption of the report seems to have been that Hetch Hetchy Valley only has positive economic value if it is being used as a reservoir; put differently, this assumes that the opportunity cost of damming Hetch Hetchy was (and is) zero.¹⁰⁴ A 1988 report prepared by the California Assembly Office of Research goes a bit further by analyzing the potential recreation value a restored Hetch Hetchy Valley would provide based on low, medium, and high development scenarios. The report stated that, when the state purchases park lands, “we decide that the public recreation value outweighs the value of the land in private ownership.”¹⁰⁵ While the report clearly recognized that an un-dammed Hetch Hetchy does have some value, it left out the non-use value that natural resources may have. This unaccounted for non-use value may be quite large and constitute a large portion of potential restoration benefits. (An explanation of non-use value or “existence value” will follow in the economic analysis section of this report.) The National Park Service and/or Yosemite National Park have never undertaken cost-benefit studies of restoring Hetch Hetchy because the Raker Act requires the Park to work with San Francisco in the stewardship of Hetch Hetchy. Any changes to that relationship have to come from Congress. In effect, the Park is prohibited from initiating study of dam removal because of its role in maintaining the reservoir with San Francisco.¹⁰⁶

Although those advocating restoration may now be better organized, and the environmental movement as a whole may be on stronger footing in the United States, the same issues continue to be discussed over and over again in the debate over whether to restore Hetch Hetchy. The City of San Francisco continues to assert its needs matter more than any environmental concerns; the City’s official history of Hetch Hetchy Water and Power notes “Advantages to the vast majority of the population and the general public welfare rendered any damage to the environment slight by comparison.” No systematic comparison was ever done, yet San Francisco continues to dismiss suggestions that Hetch Hetchy may have a higher value in other uses and refuses to support any studies or investigations that may suggest alternatives to a reservoir at Hetch Hetchy.

Present Debate Still Dominated By Old Views and Political Hardball

This view, from a political perspective, is understandable. Given California’s complex system of water rights and the advantages to San Francisco of receiving its water below its true economic cost, Dianne Feinstein’s vehement defense of San Franciscan’s “birthright” to Hetch Hetchy and

¹⁰⁴ “Hetch Hetchy: Striking a Balance. A review of the Department of the Interior’s Survey of Water and Replacement Concepts for Hetch Hetchy.” Department of Energy, 1989.

¹⁰⁵ “Restoring Hetch Hetchy” prepared by the Assembly Office of Research, California State Legislature, No.0220-A, June 1988.

¹⁰⁶ Telephone interview with Yosemite National Park Historian James Snyder, 17 March 2004.

her charge that restoring Hetch Hetchy would be “dumb, dumb, dumb”¹⁰⁷ is understandable. For San Francisco, Hetch Hetchy represents a very, very good deal. For one thing, the Hetch Hetchy system provides water and hydroelectric power far in excess of San Francisco’s own needs. The City gets \$40 to \$50 million dollars per year from the sale of excess water and power. “As it races downward from the Sierra to the valley floor, the water from Hetch Hetchy produces electricity, which yields tens of millions in revenues every year. Where does it go? Not to those 31 [municipal] water users. Not even to maintain the water system. It all goes to San Francisco, where it is spent on Muni transit, homeless programs, police and all the various services that run that city.”¹⁰⁸ In the restoration debate, city officials argue the City would have to be compensated if these benefits were taken away. Few in the debate point out that San Francisco could be construed as owing U.S. taxpayers for the benefits it receives. In a recent study of the technical feasibility of removing the dam at Hetch Hetchy, it was noted that “...removing O’Shaughnessy Dam could increase Bay Area drinking water costs significantly, to levels common for most California cities” suggesting that San Francisco currently pays far less for its water than other California cities.¹⁰⁹ Recently, the Bush Administration proposed an increase in the fee from \$30,000 per year to \$8 million, prompting an outcry from city officials and drawing attention to the “free” benefits the City reaps from Hetch Hetchy.¹¹⁰

The City of San Francisco does not acknowledge that flooding Hetch Hetchy Valley constitutes damage to the environment. “Today, as then, Hetch Hetchy people believe Muir was wrong—that a cruel fate indeed would have befallen Hetch Hetchy had the water supply project failed. For, at that time, the automobile was in its ascendancy and it would have been only a matter of time before roads were built into the back country.”¹¹¹ This statement employs a curious logic: Hetch Hetchy Water and Power saved the valley from exploitation by flooding it. The assertion that roads would have invaded Hetch Hetchy had not San Francisco “saved it” ignores the fact that the only road built in the area to date was constructed by Hetch Hetchy Water and Power in order to transport workers and equipment to the valley.¹¹² The logic that Hetch Hetchy Water and Power employs not only implies that the benefits outweighed the costs when it came to damming Hetch Hetchy, rather it seeks to transform a cost (the destruction of the valley floor) into a benefit (a valley saved from exploitation).

¹⁰⁷ Philip, Tom. “Water: Bring Back Hetch Hetchy?” Sacramento Bee, 21 April 2002.

¹⁰⁸ Ibid.

¹⁰⁹ Null, Sarah E. “Re-Assembling Hetch Hetchy: Water Supply Implications of Removing O’Shaughnessy Dam”, Thesis for the Master of Arts in Geography, University of California, Davis, December 2003.

¹¹⁰ “S.F. to Fight Reservoir Rent Hike” Los Angeles Times, February 5th, 2004.

¹¹¹ “Hetch Hetchy Water and Power: A History of the Municipal Water Department and Hetch Hetchy System” City and County of San Francisco, p. 27, Fifth Printing, 2002.

¹¹² Telephone interview with Yosemite National Park Historian James Snyder, 17 March 2004.

Appendix IV: General Assumptions Regarding Key Biological Events of Restoration

This assumes the key events of restoration to proceed in accordance with *Alternatives For Restoration Of Hetch Hetchy Valley Following Removal Of The Dam And Reservoir*, a document prepared by the Park Service in 1988. According to the National Park Service document, the key events of restoration with intensive management would be:

- The Hetch Hetchy reservoir would then be progressively drained over a five year period to permit a more controlled opportunity for re-vegetation. In each of these five years, native vegetation would be restored on ten to twenty-five percent of the land exposed by the progressively draining of the reservoir.
- FIVE YEARS AFTER BEGINNING OF DRAINAGE: The entire valley would be exposed and partially planted with native vegetation. Vegetation at the upper end of Hetch Hetchy would be much Burr extensive and well developed than at the lower end. Conifers would be up to fifteen feet high and black oaks would be about six feet high in areas planted the first year. Many native herbaceous taxa would have become germinated and would have established in some areas; native plants would be...firmly established because non-natives would be suppressed. Watering and other techniques would insure greater survival and vigor of plantings.
- TEN YEARS: Native plants would be much more prominent in the valley. Most of the original plant communities would be represented. There would be a high survival rate for plantings and most would be growing vigorously. Native grasses and sedges would be dominant in the meadows and would be reproducing and successfully competing with non-native plants.
- FIFTY YEARS: Plant community boundaries would be stabilizing and would resemble those that originally occurred in Hetch Hetchy. Prescribed burning initiated after about twenty years would have prevented rapid conifer encroachment on oak woodlands and meadows, thinned thickets of ponderosa pine and incense cedar, and produced a more natural species composition and distribution in coniferous forest areas.
- ONE HUNDRED YEARS: Ponderosa pines and incense cedars would be 125 to 150 feet high. The conifer forest would resemble that growing on the floodplain of Yosemite Valley in 1987 except that it would generally be more open. Some dense clusters of conifers, missed by fire, would occur in localized areas. Oak woodlands would be extensive and starting to mature. The even-aged clusters of conifers and oaks would stand in contrast to the more varied mixed-conifer forests outside Hetch Hetchy.
- ONE HUNDRED AND FIFTY YEARS: Forest and woodland communities would be nearing maturity, and the entire valley would appear much as it did before construction of the reservoir.

WILDLIFE RESPONSE:

- “The slow elimination of aquatic habitat would gradually reduce prey traditionally consumed by Peregrine Falcons while alternate prey habitats were developing.” The initial decline in prey habitat would be offset by the long term improvement of prey habitat in the valley floor. Prey habitat would improve within 15-20 years of drawdown.
- Bald eagles that winter at Lake Cherry occasionally feed at the Hetch Hetchy reservoir. Eagles’ use of Hetch Hetchy would be extended through the five years of drawdown. Foraging opportunities would likely improve for bald eagles during that time due to increased availability of fish as the depth and surface area of the reservoir decreased. Eventually, bald eagles would stop using that part of the Park, but this is unlikely to change the population of bald eagles in the Park overall.
- Seasonal deer use of the valley would begin the first year as herbaceous forage became available and the dry valley bottom began to provide acceptable travel routes to the other side of the canyon. Similarly, black bears would take advantage of the green grass and herbaceous plants during the spring months. As hiding cover, thermal cover, and reproductive habitat became available, probably about [15 years] following dewatering, use of the valley by both species would increase in other seasons.
- Small mammals, amphibians and reptiles would naturally reoccupy the valley from surrounding habitats, probably within five years of food and cover becoming suitable. Since monitoring efforts, would include more species, there would be more opportunity to enhance vegetative recovery, encourage population growth of predator suppressed prey, and insure re-colonization by most species.
- The long term result would be all but two native species resident in Hetch Hetchy Valley in abundances and distributions that would closely reflect pristine conditions. Ecosystem recovery time would be minimized.¹¹³

¹¹³ National Park Service, Alternatives For Restoration Of Hetch Hetchy Valley Following Removal Of The Dam And Reservoir , February 1988.

Appendix V: List of Interview Contacts

<i>Name</i>	<i>Title</i>	<i>Organization</i>
Aaron J. Douglas	Economist	United States Geological Survey
Dr. Michael Hanemann	Professor of Agricultural and Resource Economics	UC Berkeley
Gala Miller	Chief of Interpretation	Mount Saint Helens National Monument
Mark Cederborg	Project Manager	Hanford ARC
Jen Nissenbaum	Easter Sierras Policy Coordinator	Mono Lake Committee
Ron Good	CEO	Restore Hetch Hetchy
Scott Gediman	Chief of Media Relations	Yosemite National Park
Deb Schweizer	Park Ranger	Yosemite National Park
James Snyder	Historian	Yosemite National Park

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